ARCADIS
Infrastructure · Water · Environment · Buildings

ARCADIS
10559 Citation Drive
Suite 100
Brighton
Michigan 48116
Tel 810.229.8594
Fax 810.229.8837
www.arcadis-us.com

ENVIRONMENT

James Saric
Remedial Project Manager
USEPA Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, IL 60604-3590

Subject:
Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/ Feasibility Study (SRI/FS) Work Plan

Date:
March 29, 2012

Contact:
Michael J. Erickson, P.E.

Phone:
734.604.7044

Email:
michael.erickson@arcadis-us.com

Our ref:
B0064531.00500

Dear Mr. Saric:

On behalf of Georgia-Pacific LLC (Georgia-Pacific), please find enclosed the revised *Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan* (Area 3 Work Plan) submitted for U.S. Environmental Protection Agency (USEPA) approval. The Area 3 Work Plan has been revised to address the comments received from USEPA on January 30, 2012 and comments received from the Michigan Department of Environmental Quality (MDEQ) on February 23, 2012. The Area 3 Work Plan was revised consistent with the responses to the USEPA and MDEQ comments that are also provided under this letter.

We look forward to USEPA approval of the work plan, upon which we will commence collaboration with the agencies on details of field work to be completed this year.

If you have any questions, please do not hesitate to contact me.

Sincerely,

ARCADIS

Michael J. Erickson, P.E.
Vice President

Enclosures:
2 Hard Copies

Copies:

Paul Bucholtz, MDEQ (3 hard copies)
Judith Alfano, MDEQ (electronic copy)
Mark Mills, MDNR (electronic copy)
Sharon Hanshue, MDNR (1 hard copy)
Todd Goeks, NOAA (electronic copy)
Lisa Williams, Ph.D., USFWS (electronic copy)
Jeff Keiser, CH2M HILL (1 hard copy)
Garry Griffith, P.E., Georgia-Pacific, LLC (1 hard copy)
Mark Brown, Ph.D., Waterviews, LLC (electronic copy)
Martin Lebo, Ph.D., Weyerhaueser (electronic copy)
Richard Gay, Weyerhaueser (electronic copy)
Kathy Huibregtse, Environ (electronic copy)

GEORGIA PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
RESPONSES TO USEPA'S JANUARY 30, 2012 COMMENTS ON THE
AREA 3 SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN, MARCH 2012

USEPA Specific Comment 1:

Section: 1 Page: 1-5

> Last paragraph, HHRA – please see Specific Comment #5. This paragraph will need to be revised if a gardening/produce consumption pathway is included in the HHRA.

Response

The following sentence has been added to Section 4.6.2 "If current use of the impoundment is documented to include continued vegetable gardening, the potential need to evaluate this pathway will be discussed with USEPA."

The following text has also been added to Section 6.2: "An adjacent property owner on the north side of the impoundment had once used a portion of the State land within the impoundment for a vegetable garden. This home owner was notified by the State that gardening was not permitted. No further information concerning gardening activity in the impoundment has been reported. As part of SRI activities, a land use assessment for Area 3 will be prepared, and will incorporate a site walk to observe and record land use activity, in addition to inspection of high resolution air photos. The HHRA completed by CDM (2003b) noted the presence of the garden but did not include a gardener scenario. If continued vegetable gardening within the former impoundment is documented, the need to prepare a risk assessment for humans consuming vegetables grown in the floodplains will be discussed with USEPA, and if required, this will be incorporated in the Area 3 HHRA in a manner consistent with applicable USEPA guidance."

USEPA Specific Comment 2:

Section: 2 Page: 2-1

> First paragraph in Section 2- the basis for the study area boundary should be explained. Some of this information is provided on page 5-3 (Step 4 of the DQOs); please move this description to Section 2 and expand so that it is clear that the study area boundary encompasses all areas that may have been affected by historical inundation and 'flooding.

Response

Text has been added in Section 2 as follows:

> "The specific Study Area boundary of the investigation area (shown on Figure 2-1) was derived from the outer extent of FEMA 100-year floodplain boundary, the 683-foot (NGVD 29) contour, and visually identified impounded areas from historical aerial photographs

(see Figures 2-2a through i), in order to incorporate regions that may have been affected by historical flooding and inundation. The Study Area boundary may be reassessed in certain locations based on the results of field reconnaissance work (i.e. prior to sampling) and based on the simulated water surface elevations from the proposed hydrodynamic modeling (see Section 5.5)."

USEPA Specific Comment 3:

Section: 2.1.2 Page: 2-4

Any documentation regarding the approximate amount of sediment removed in 2000 from the Pine Creek drawdown should be included. Additionally, the USGS reports identify a release of sediments from the Pine Creek drawdown, and subsequent deposition in the Otsego impoundment. The stipulated drawdown frequency for the Pine Creek impoundment (i.e., every 5 years), should be included along with the dates of historic drawdown activities.

Response

Information on the Pine Creek drawdown was taken from the USGS 2004 Water Resources Investigation Report (Rachol et al., 2005). This report does not document the frequency of drawdown or the volume of sediment removed from Pine Creek during the drawdown period and no further documentation on this subject has been found for inclusion in the Work Plan. The 2000 Supplemental Remedial Investigation report includes duration of the 2000 drawdown for the Pine Creek Impoundment, which is included in the text. ARCADIS will consider any additional information that becomes available relating to this subject.

USEPA Specific Comment 4:

Figures 2-1, 2-3a, and 2-3b

The extent of the former Otsego impoundment is defined as a solid gray line in the legend; however, this line is not shown on the map. This comment also applies to Figures 2-3a and 2-3b.

Response

The solid gray line indicating the extent of the former Otsego Impoundment has been removed from the legend of Figures 2-1, 2-3a, and 2-3b.

USEPA Specific Comment 5:

Section: 3 Page: 3-3

> Second bullet- "In August 2000, MDEQ wrote a letter advising the gardener to abandon the garden, expressing concern due to the presence of PCBs." The HHRA should include an analysis of the risk associated with gardening and consuming produce using the MDEQ data to address potential public concern related to this letter.

Response

The following sentence has been added to Section 4.6.2: "If current use of the impoundment is documented to include continued vegetable gardening, the potential need to evaluate this pathway will be discussed with USEPA."

The following text has also been added to Section 6.2: "An adjacent property owner on the north side of the impoundment had once used a portion of the State land within the impoundment for a vegetable garden. This home owner was notified by the State that gardening was not permitted. No further information concerning gardening activity in the impoundment has been reported. As part of SRI activities, a land use assessment for Area 3 will be prepared, and will incorporate a site walk to observe and record land use activity, in addition to inspection of high resolution air photos. The HHRA completed by CDM (2003b) noted the presence of the garden but did not include a gardener scenario. If continued vegetable gardening within the former impoundment is documented, the need to prepare a risk assessment for humans consuming vegetables grown in the floodplains will be discussed with USEPA, and if required, this will be incorporated in the Area 3 HHRA in a manner consistent with applicable USEPA guidance."

USEPA Specific Comment 6:

Tables 3-2, 3-3

> Data usability categories should be defined in the footnote for these tables. Are they the same as the data usability designations used in Table 3-1?

Response

The notes in Tables 3-2 and 3-3 have been updated to include definitions of data usability categories. Furthermore, Table 3-1 sample numbers have been updated to include duplicate samples to maintain consistency with Table 3-2.

USEPA Specific Comment 7:

Section: 3 Page: 3-5

First paragraph, second sentence - this sentence lists datasets that are excluded from the statistical analyses of existing data. Please add a footnote to Table 3-4 that specifies the data sets that are included in the statistical summaries.

Response

Notes have been added to Table 3-4 indicating the datasets that are considered in the Area 3 statistical summaries.

USEPA Specific Comment 8:

Section: 3 Page: 3-5

First paragraph - add a sentence to the end of the paragraph that states "However, all available data will be included and considered in the Area 3 SRI Report."

Response

The text in the first paragraph of Section 3.2 has been amended to indicate that all available data will be presented and relevant data will be used to define nature and extent in the Area 3 SRI report.

USEPA Specific Comment 9:

Section: 3 Page: 3-5

Footnote 2 - This footnote indicates that PCBs were detected at concentrations up to 16 mg/kg in core FF-66 from Pine Creek. A footnote to Table 3-4 states that this location falls outside of the primary Area 3 impoundment; however, the sample results indicate that it is clearly affected by PCB contamination. Please rectify the apparent inconsistency between the footnotes in the text and table.

Response

Sample location FF-66 is located in the Pine Creek Pond and falls within the Pine Creek Study Area boundary which has been identified separately from the Area 3 Study Area boundary. Therefore, the statistical summary for this sample is included separately in Table 3-4. Both the

Footnote in Section 3.2 and note 4 in Table 3-4 have been updated to clarify the study area for this location.

USEPA Specific Comment 10:

Section: 3 Page: 3-9

> Section 3.4.4- it would helpful to include a map in the work plan showing the wetland areas.

Response

The NWI Area 3 Wetland map from the 2000 Remedial Investigation Report has been added as Appendix F to the revised Draft Area 3 SRI/FS Work Plan. Text has been incorporated into Section 3.4.4 to explain that wetlands will be evaluated and surveyed during the proposed reconnaissance phase to reconfirm boundaries.

USEPA Specific Comment 11:

Figure 4-1 Page: 4-2

> It appears there was approximately a 3 foot difference in surface water elevation between the 9/22 and 10/6 datasets resulting in the graph showing water moving up hill. Please use a single data set and identify where data are missing to provide a better representation of the water surface elevation along the river.

Response

The water depth measurements for transects KPT94 (directly upstream of the Otsego Dam) and KPT86 (upstream of the M-89 road bridge) were taken at similar times to other transects in the reach, however have resulted in an anomalous water surface profile. These transect points have therefore been removed from Figure 4-1 and a note has been added to the figure to explain these removals.

USEPA Specific Comment 12:

Section: 4 Page: 4-2

> Second line on page - "... tend to decrease quickly with distance ..." Please delete the word "quickly."

Response

The text in Section 4.1 has been amended as requested.

USEPA Specific Comment 13:

Section: 4 Page: 4-6

> Page 4-8, first paragraph, third sentence - "These deposits ... were typically thickest ..." Change "were" to "are."

Response

The text in Section 4.2.2 has been amended as requested.

USEPA Specific Comment 14:

Section: 4 Page: 4-11

> Section 4.6.2, third paragraph. Please see Specific Comment #4. Identify how the gardening scenario will be addressed in order to close the loop on the 2000 MDEQ letter to the gardener.

Response

The following sentence has been added to Section 4.6.2: "If current use of the impoundment is documented to include continued vegetable gardening, the potential need to evaluate this pathway will be discussed with USEPA."

USEPA Specific Comment 15:

Section: 5 Page: 5-1

> Step 2, "Identify the Goals of the Study" - add a bullet that states "Estimate PCB-containing bank soil erosion rates"

Response

A bullet has been added in Section 5.1 (step 2) stating that one of the goals of the Area 3 study will be estimating PCB loading from bank erosion.

USEPA Specific Comment 16:

Section: 5 Page: 5-3

> Step 5, Develop the Analytic Approach - Add a bullet that states "Spatial mapping of surface and core maximum sediment and floodplain soil PCB concentrations"

Response

An additional bullet has been included in Section 5.1, Step 5 as requested.

USEPA Specific Comment 17:

Section: 5.2 Page: 5-4

> Data collection for non-PCB constituents in Area 3 must follow the same approach as that of Area 2.

Response

During discussions held on 2/28/12 in Chicago, USEPA and Georgia-Pacific/ARCADIS agreed that additional analysis will be performed on already-collected non-PCB data for the site prior to defining the final Study Area 3 approach non-PCB data collection. Additionally, ARCADIS will provide a White Paper discussing the non-PCB constituents that are associated with paper-making residuals, with the aim of providing a more condensed list of non-PCB constituents for analysis. Final non-PCB data collection will be defined in an Area-specific Field Sampling Plan for USEPA approval.

USEPA Specific Comment 18:

Section: 5 Page: 5-5

> River Bank and Floodplain Soil - Add a bullet that states "Floodplain soil PCB data in areas potentially affected by flooding throughout Area 3"

Response

A bullet has been added to Section 5.2 as requested.

USEPA Specific Comment 19:

Section: 5 Page: 5-8

> Section 5.3.1.3, first bullet-"... substantial deposits/ accumulations of fine-grained sediments will be noted." Clarify what is meant by "substantial" and how these deposits will be identified from a boat.

Response

Further clarification has been included, as requested, in the text in Section 5.3.1.3.

USEPA Specific Comment 20:

Section: 5 Page: 5-9

> Section 5.3.3, first paragraph- "In areas where existing PCB data are available, samples will be used to characterize final strata as an *a* priori consideration to future sampling." The meaning of this sentence is unclear; please revise to clarify.

Response

The sentence in Section 5.3.3 has been rewritten: "For areas where there are PCB data from prior efforts, those existing data will be used to characterize final strata and guide future sampling."

USEPA Specific Comment 21:

Section: 5 Page: 5-10

> Section 5.3.4 - "Some random sampling may also be included outside of strata of interest to assess or confirm PCB levels in areas believed unlikely to contain elevated PCB concentrations." Please change "may" to "will."

Response

The text in Section 5.3.4 has been revised to read: "In conjunction with biased sampling of fine sediments, additional random sampling will also be included to provide supplemental data from coarse strata in under sampled areas."

USEPA Specific Comment 22:

Section: 8 Page: 8-1

Include the submittal of the locations for reconnaissance activities into the schedule.

Response

Table 8-1 has been updated to indicate that the proposed Area 3 reconnaissance locations will be submitted to the agencies for review in April 2012.

Editorial Notes:

Page 1-3, 3'd bullet in list of Multi-Area documents- "Multi-Area Quality Assurance Sampling Plan (QAPP)" -change "Sampling" to "Project"

Page 4-9, second paragraph-" ... sediment that have ..." Change "sediment" to "sediments."

Response

Editorial revisions have been made as requested.

GEORGIA PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
RESPONSES TO MDEQ'S FEBRUARY 23, 2012 COMMENTS ON THE
AREA 3 SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN, MARCH 2012

SPECIFIC COMMENTS

MDEQ Specific Comment 1:

Table 2-1 Page: 2-2

Include the formerly impounded area and length for Otsego.

Response

The formerly impounded area for Area 3 was recorded in an interoffice communication document from Herbert Miller to Gaylord Walker (Michigan Department of Conservation) as 330 acres. No further data were provided about this area and the basis is unknown. The formerly impounded length for the Otsego impoundment is provided in Table 2-1. The following footnote has also been added to the table: "The formerly impounded area for Area 3 is identified as the area within the Study Area boundary and is approximately 250 acres, excluding the Pine Creek area. Including the Pine Creek area, the study area is 320 acres."

MDEQ Specific Comment 2:

Section: 2 Page: 2-2

If possible, there should be discussion to the potential maximum flood elevation for the impoundment (i.e., elevation greater than stated approximate pool elevation of 683 feet).

Response

No Flood Insurance Study exists for the Otsego impoundment; therefore, the potential maximum flood elevation is not available. CDM performed modeling of the impoundment in 2001; however, the model did not account for any overbank flow or storage capacity and was not used in development of the Study Area boundary. The 100-year floodplain was included in the figures through digitization of the FEMA Flood Insurance Rate Map boundary. A discussion on the derivation of the Study Area boundary has been included in Section 2.

MDEQ Specific Comment 3:

Section: 2 Page: 2-4

> Any documentation regarding the amount (or approximate amount) of sediment removed in 2000 from the Pine Creek drawdown should be included. Additionally, the United States Geological Survey (USGS) reports do identify the release of sediments from the Pine Creek drawdown, and the subsequent deposition in the Otsego Impoundment. The stipulated drawdown frequency for the Pine Creek Impoundment (i.e., every 5 years) should be included along with the dates of historic drawdown activities.

Response

Please see response to USEPA Specific Comment 3.

MDEQ Specific Comment 4:

Section: 3-3 Page: 3-6

> There is one sediment sample collected by the MDEQ/USGS from just upstream of the Otsego Impoundment (along the right bank) that was analyzed for polychlorinated biphenyls (PCBs), pesticides, herbicides, metals, volatile organic compounds, semi-volatile organic compounds, and total organic carbon. This sample should be included in the non-PCB dataset. The sample was collected in an unbiased manner (i.e., not targeting specific sediment), using similar collection techniques (i.e., Lexan core driven to refusal).

Response

It is assumed that the comment refers to the MDEQ sample (USGS-2) that is located just upstream of the Otsego Dam, rather than the Otsego Impoundment. This sample location and data has been included in Table B-1 and Figure B-1 (Appendix B) and Section 3.3 has been updated to refer to this sample point.

GEORGIA PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
RESPONSES TO MDEQ'S FEBRUARY 23, 2012 COMMENTS ON THE
AREA 3 SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN, MARCH 2012

MDEQ Specific Comment 5:

Figure 4-7 Page: 4-7

> The figure shows one sample at a PCB concentration of —10 milligrams per kilogram (mg/kg) and at an elevation of just under 689 feet. This result appears to be missing from Figure 3-3, and if so, it should be included. This issue also plays into the question regarding the elevation at which we no longer expect to find contaminated residuals.

Response

The sample MDEQ has identified is OES3-7, which was included in Figures 3-1 through 3-3 in the Draft Area 3 Work Plan (yellow circle near Jefferson Road). Per recorded survey data, the elevation at this point is 688.63 ft. In the course of a review of the historical data for Area 3, two transects were found to be plotted in error (KPT82 and its collocated transect KP13C, and OES3). These transect locations have been corrected on the figures presented in the Area 3 Work Plan, as applicable. A note has been added to Figure 4-7, identifying that the outlying sample point is OES3-7, located to the north of the previous channel located immediately downstream of the former railroad bridge. This note also identifies that the ground elevation at OES3-7 will be re-surveyed, and potentially re-sampled, during field sampling work.

MDEQ Specific Comment 6:

Page 4-8

> The MDEQ historically collected surface water samples immediately downstream of the Otsego Dam (-200 feet) during a few events in 1999, 2000, and 2001. These surface water data represent the "outlet" of the impoundment and should be considered when analyzing surface water leaving the impoundment.

Response

Text has been included in Section 4-4: "Additional MDEQ surface water data are available from a location immediately downstream of the Otsego Dam. These data will be considered and included, as applicable, in the Area 3 SRI Report"

MDEQ Specific Comment 7:

Section: 5.1 Page: 5-3

> The specific Study Area boundary of the investigation area (shown on Figure 2-1) appears to capture the vast majority of areas where contamination has come to rest. However, it appears that some areas, where slopes out of the floodplain are more gradual, may not be completely captured. These areas, which are limited in scope, will likely require more consideration before the final boundary is established. Specifically, two such areas include the floodplain on the south side of the river, upstream of the M-89 bridge, and the floodplain on the north side of the river, near and downstream of the M-89 bridge.

Response

It is recognized that the Study Area boundary may be subject to limited change based on the results of the area reconnaissance. The Study Area boundary will be further assessed by the simulation of a 100-year flood in the proposed hydrodynamic model of the area. This is noted in Sections 2 and 5.

MDEQ Specific Comment 8:

Page: 5-5

> The bullets, included under Section 5.2, outline the specific data that will be collected for Area 3. Fish tissue is included, but it is not clear if this is data in addition to the MDEQ data. Additionally, the MDEQ collected data in the impoundment in 2011, and those data should be available in summer 2012. Identify a placeholder in this section for this data.

Response

A bullet has been added in Section 3 noting, "Fish tissue PCB samples have been collected intermittently in Area 3 since the 1980s and long-term records are available for certain species, in particular smallmouth bass and carp. Data that MDEQ collected within the impoundment in 2011 will be made available in summer 2012 and will be considered in the development of the Area 3 SRI Report." Furthermore, text in Section 5.2 has been updated to state that MDEQ fish data will be used as applicable in the update of the angler risk calculations.

MDEQ Specific Comment 9:

Section: 5.3.1.2 Page: 5-8

a. For Area 2, use of the Dutch auger was appropriate for shallow classification; however, there were many instances of material of interest being deeper than 2-3 feet. Many times, CDM Smith used a two-inch Lexan tube in the same hole to characterize deeper soils. Additional equipment should be available to the field staff to go deeper than 3 feet.

b. For Area 2, use of the handheld Global Positioning System (GPS) was problematic in areas due to limited satellite reception. If points identified during the reconnaissance work are targeted for sampling, either a Real Time Kinematic GPS unit should be used or stakes be driven to mark locations.

Response

Section 5.3.1.2 has been revised to address the use of additional equipment, if needed, while conducting field work in Area 3.

MDEQ Specific Comment 10:

Section: 5.3.1.3 Page: 5-8

It is unclear from the text how the soft sediment reconnaissance will be conducted, but assume it will be similar to Area 2 (i.e., in boat with one person using rod/Lexan to probe as boat is motoring and/or stopped at single location). Because the Area 2 braided channels are much smaller (60-90 feet wide) compared to the Area 3 single channel (160-300 feet), the utility of this method might not be as effective for identifying a majority of areas with soft sediment. Additional sediment transects should be added to supplement existing transects, and soft sediment deposits between transects should be identified with the proposed approach. Transects should be sampled for PCBs and not simply probed (see comment on Section 5.3.4).

Response

Further detail on the approach for soft sediment reconnaissance has been included in Section 5.3.1.3. Additionally, sediment core and probe transects will be proposed as part of the sampling phase, which will follow reconnaissance.

MDEQ Specific Comment 11:

Section: 5.3.4 Page: 5-10

> In addition to soft sediment areas identified during the reconnaissance, in-stream sediment samples should be collected along new transects to supplement existing transects within Area 3.

Response

Sediment sampling is proposed during a sampling phase subsequent to reconnaissance and will be described as part of the Area-Specific Field Sampling plan. Supplemental probing/PCB sampling transects will be added between existing transects.

MDEQ Specific Comment 12:

Section: 5.3.3 Page: 5-9

> The use of multiple three-inch Lexan cores at one location provided better recovery of soil and less compaction than simply driving a single smaller diameter macrocore and/or Lexan. While collection techniques are not discussed here, it is assumed that the approach taken in Area 2 with respect to bank/floodplain soil collection will be utilized in Area 3.

Response

This comment is noted and collection techniques will be described in the Area-specific Field Sampling Plan.

MDEQ Specific Comment 13:

Section: 6

> Section 6 of the Work Plan is unnecessary and is inconsistent with previous
>
> Work Plan activities on the river (e.g., Area 2 Work Plan). An initial step in the Risk Assessment process is the Risk Assessment Framework identified in
>
> Section 1.2.1.5 of the Statement of Work to the AOC. It is not clear from the AOC why the Risk Assessment information is being presented in this Work Plan. It will be better to discuss the Risk Assessment process from Area 3 outside of this SRI Work Plan.

Response

As specified by the SOW, any Area-specific risk assessment considerations are to be included with the Area-specific Work Plans, and risk assessments are to be prepared for each area. For Area 1, the Baseline Ecological Risk Assessment Work Plan was submitted as a supplement to the Area 1 SRI/FS Work Plan. This was because the Area 1 SRI/FS Work Plan was submitted to and approved by USEPA in February 2007 as part of the AOC/SOW development, and the peer review process was conducted to help define certain aspects of the risk assessment approach. For Area 2, risk assessment considerations were included in Section 4.3 of the Work Plan, but the Area 1 risk assessment had yet to be completed. Because of the status of continuing risk assessment work at the Site, for Area 3, it is appropriate to provide more information on risk assessment considerations in the work plan.

MDEQ Specific Comment 14:

Table 3-3

Missing MDEQ data sets for Otsego Impoundment 2011 fish and surface water (not yet sent to ARCADIS).

a. 1999 and 2001 caged channel catfish and Semi-Permeable Membrane Device data.

b. 1999, 2000, and 2001 surface water data from a station —200 feet downstream of the Otsego Dam.

Response

Table 3-3 has been updated to include MDEQ fish and surface water data from 1999, 2000, and 2001. 2011 data will be considered when received from MDEQ.

MDEQ Specific Comment 15:

Figure 2-1

a. The study area boundary for the Kalamazoo River should include all low-lying areas within the floodplain (e.g., the boundary line appears to miss a portion of the floodplain on the south side of the river, upstream of the M-89 bridge).

b. The initial study area boundary for Pine Creek seems appropriate as a starting point; however, the boundary may need to extend further south than depicted, depending upon the data results.

Response

Text has been added to Sections 2 and 5 stating that the Study Area boundary will be reassessed based on the results of field reconnaissance work and based on the simulated water surface elevations from the proposed hydrodynamic modeling.

MDEQ Specific Comment 16:

Figures 3-1 through 3-3

Sediment/soil data collected by the MDEQ should be depicted in the figures.

Response

Figures 3-1 through 3-3 have been updated to include MDEQ data as appropriate.

MDEQ Specific Comment 17:

Figure 3-3

a. The maximum PCB figure appears to either be missing data or the data symbols are incorrect. Two examples are KPT93-1 (156 mg/kg) and OES4-5 (116 mg/kg).

b. Coordinates for sediment samples labeled RTM-1, RTM-2, and RTM-3 in the ARCADIS database appear to have incorrect coordinates, as these samples plot outside the floodplain in residential neighborhoods. If these data are used in the SRI, the coordinates should be updated in the database.

Response

Figure 3-3 includes all sample locations in Area 3 with most recent data on top. Since some of the 1993 sample locations were re-sampled in 2000, these locations are plotted on top of the original (potentially higher PCB concentration) location. A note has been added to Figure 3-1 to identify that the most recent sample event is shown for collocated cores. Figures 3-2 and 3-3 have been updated to show maximum PCB concentrations in the event of collocation and a note has been added to explain this.

Samples RTM-1, RTM-2, and RTM-3 were collected as part of the source investigation and so may not be directly associated with the river. The samples will be discussed as part of the Area 3 SRI Report, but are not intended to be used for the nature and extent characterization of PCBs associated with the former impoundment.

ARCADIS

Infrastructure · Water · Environment · Buildings

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Supplemental Remedial Investigations/Feasibility Studies

Area 3/Former Otsego Impoundment SRI/FS Work Plan

Georgia-Pacific LLC

March 2012

ARCADIS
Infrastructure · Water · Environment · Buildings

Allied Paper, Inc./Portage Creek/ Kalamazoo River Superfund Site

Supplemental Remedial Investigations/ Feasibility Studies

Area 3 / Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Georgia-Pacific LLC

March 2012

ARCADIS

Michael J. Erickson, P.E.
Project Coordinator

Area 3 / Former Otsego Impoundment Supplemental Remedial Investigation/ Feasibility Study Work Plan

Prepared for:
Georgia-Pacific LLC

Prepared by:
ARCADIS
10559 Citation Drive
Suite 100
Brighton
Michigan 48116
Tel 810.229.8594
Fax 810.229.8837

Our Ref.:
B0064531.00500

Date:
March 2012

Table of Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

AOC	Administrative Settlement Agreement and Order on Consent
ASTM	Alternatives Screening Technical Memorandum
ATSDR	Agency for Toxic Substances and Disease Registry
BBL	Blasland, Bouck & Lee, Inc.
BERA	Baseline Ecological Risk Assessment
CDM	Camp, Dresser & McKee
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CSM	Conceptual Site Model
cy	cubic yards
DQO	data quality objective
EPC	Exposure Point Concentration
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
FSP	Field Sampling Plan
Georgia-Pacific	Georgia-Pacific LLC
GPS	global positioning system
HEC-RAS	Hydrologic Engineering Center River Analysis System
HHRA	Human Health Risk Assessment
HSP	Health and Safety Plan
kg	kilograms
KRSG	Kalamazoo River Study Group
Lyondell	Lyondell Chemical Company
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
mg/kg	milligrams per kilogram
MHLLC	Millennium Holdings, LLC

NCP	National Contingency Plan
NGVD 29	National Geodetic Vertical Datum of 1929
OSI	Ocean Surveys Inc.
OU	Operable Unit
OU5	Operable Unit 5
PCB	polychlorinated biphenyl
QAPP	Quality Assurance Project Plan
RA	Risk Assessment
RBCs	Risk-Based Concentrations
RI	Remedial Investigation
ROD	Record of Decision
SEDMOD	Sediment Transport Model
SME	Soil and Materials Engineers, Inc.
SOW	Statement of Work
SRI	Supplemental Remedial Investigation
TAL	Target Analyte List
TBERA	Terrestrial Baseline Ecological Risk Assessment
TCL	Target Compound List
TCRA	Time-Critical Removal Action
TOC	total organic carbon
TSS	total suspended solids
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
1-D	one-dimensional

1. Introduction

On February 21, 2007, Georgia-Pacific LLC (Georgia-Pacific) and Millennium Holdings, LLC (MHLLC), also known as the Kalamazoo River Study Group (KRSG), voluntarily entered into an Administrative Settlement Agreement and Order on Consent (AOC) with the United States Environmental Protection Agency (USEPA). This agreement, which describes a series of supplemental remedial investigations and feasibility studies (SRIs/FSs) that will be carried out over the next several years at the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (the Site or Superfund Site), is referred to as the SRI/FS AOC (Comprehensive Environmental Response, Compensation, and Liability Act [CERCLA] Docket No. V-W-07-C-864). The work performed under the AOC is to be consistent with the implementing regulations for CERCLA, known as the National Contingency Plan (NCP).

The Superfund Site is located in Kalamazoo and Allegan Counties (Figure 1-1) and includes five operable units (OUs). Operable Unit 5 (OU5) is divided into seven areas which are bounded by dams. Area 3, which is the focus of this *Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan* (Area 3 SRI/FS Work Plan) extends from the Otsego City Dam to the Otsego Dam (Figure 1-1).

On February 5, 2009, MHLLC notified USEPA in writing that they would not be participating in any further work on the Site from that date forward as a result of the Lyondell Chemical Company (Lyondell) bankruptcy. On April 23, 2010, the U.S. Bankruptcy Court approved Lyondell's reorganization plan. An outcome of the bankruptcy process was that Lyondell/MHLLC was released of responsibility for continued work on the Kalamazoo River by the United States in exchange for a cash settlement that included approximately $100 million for Site-related work. The KRSG no longer exists, and Georgia-Pacific is currently the only potentially responsible party actively participating in AOC-related work in OU5.

1.1 Purpose of this Area 3 SRI/FS Work Plan

This Area 3 SRI/FS Work Plan describes supplemental activities that will be completed to augment the existing environmental data for the Kalamazoo River from the Otsego City Dam to the Otsego Dam (as summarized in Section 3 of this Area 3 SRI/FS Work Plan). Once the investigations described in this plan are complete, the full suite of data and information will be used to develop a SRI and FS and ultimately support a Record of Decision (ROD) for Area 3. USEPA's data usability

determination (USEPA 2009) will guide use of existing data and the supplemental data.

Results of the supplemental work and previously collected data will be described in an SRI Report for Area 3 submitted to USEPA. The SRI Report will be followed by an FS Report, developed to present the evaluation of remedial alternatives for Area 3.

1.2 Objectives of Area 3 Supplemental Remedial Investigation

The supplemental investigation data to be collected as described in this Area 3 SRI/FS Work Plan will be used together with existing information to satisfy the requirements of the AOC and the associated Statement of Work (SOW) with respect to preparation of the SRI and FS reports. Specific objectives of the supplemental investigation and feasibility study work include:

- Supplement the current characterization of the nature and extent of polychlorinated biphenyl (PCB) concentrations and non-PCB constituents (as necessary – see Section 5.2) in sediments, river banks, floodplain soils, fish, and surface water (as necessary) between the Otsego City Dam and the Otsego Dam to develop the Area 3 SRI and FS reports and support the Area-specific human health and ecological risk assessments.

- Document the current physical conditions of the Kalamazoo River and its river banks in Area 3.

- Identify and screen a range of potential approaches and technologies for remediation of Area 3.

- Select a proposed remedy for Area 3.

The general requirements for Area-specific SRI/FS Work Plans are found in Section 1.3 of the SOW and include the following:

- Area Background (see Section 2 of this Area 3 SRI/FS Work Plan)

- Multi-Area documents incorporated by reference, with Area-specific modifications as appropriate (noted throughout this Area 3 SRI/FS Work Plan)

- A description of the tasks to be performed and information needed for each task (provided in Section 5 of this Area 3 SRI/FS Work Plan)
- A description of the information to be produced through each task (provided in task descriptions in Section 5 of this Area 3 SRI/FS Work Plan)
- A description of the work products to be produced and submitted for agency review (provided in task descriptions in Section 5 and the schedule of deliverables in Section 8 of this Area 3 SRI/FS Work Plan)
- A schedule of activities (see Section 8.2 of this Area 3 SRI/FS Work Plan)
- A project management plan (see the *Quality Management Plan* [ARCADIS 2009a])

The specific USEPA-approved Multi-Area documents used to develop and implement this Area 3 SRI/FS Work Plan are:

- *Generalized Conceptual Site Model* (Generalized CSM) (ARCADIS 2009b)
- *Risk Assessment Framework* (RA Framework) (ARCADIS 2008)
- *Multi-Area Quality Assurance Project Plan* (QAPP) (ARCADIS 2010a)
- *Multi-Area Field Sampling Plan* (FSP) (ARCADIS BBL 2007a)
- *Multi-Area Health and Safety Plan* (HSP) (ARCADIS BBL 2007b)

The SOW also states that the Area-specific work plans are to describe the following, as appropriate:

- Area Reconnaissance – see Section 5.3.1 of this Area 3 SRI/FS Work Plan
- Geological Investigation – Soil and Sediment (see Sections 5.3.2 through 5.3.4 of this Area 3 SRI/FS Work Plan)
- Air Investigation – The USEPA-approved RA Framework (ARCADIS 2008) does not include the air exposure pathway based on the results of prior air sampling

investigations at the Site and conclusions of the existing Site-wide risk assessment (Camp, Dresser & McKee [CDM] 2003b); therefore, no air investigation is planned for Area 3.

- Hydrogeological (Groundwater) Investigation – At the SRI/FS Work Plan planning meeting on August 17, 2010, USEPA and the Michigan Department of Environmental Quality (MDEQ) agreed that it was not necessary to include a hydrogeologic investigation in the Area 2/Otsego City Impoundment SRI/FS Work Plan. This agreement is assumed to also be applicable for the Area 3 investigation.

- Surface Water Investigation – Flow and hydrodynamic evaluations are described in Section 3.4.2 of this Area 3 SRI/FS Work Plan; surface water PCB sampling data collected as part of the State of Michigan's Long-Term Monitoring Program (CDM 2009) are also incorporated.

- Geophysical Investigation – The geophysical investigation will include a remote topographic survey (see Section 3.4.1 of this Area 3 SRI/FS Work Plan), inspection of sediment and soil core lithology, and use of soil borings during reconnaissance.

- Ecological Investigation – Prior wetland evaluation (described in Section 3.4.4 of this Area 3 SRI/FS Work Plan) and habitat assessments (described in Section 3.4.5 of this Area 3 SRI/FS Work Plan) at the Site that have been approved for use by USEPA will be incorporated; endangered species will also be identified. No specific terrestrial biota needs are identified at this time, but if such additional data needs are identified in the SRI/FS process for Area 3, a plan for sampling will be submitted to USEPA for approval.

- Disposal of investigation-derived waste – The Investigation-Derived Waste Management Plan included as Appendix A to the Area 2/Otsego City Impoundment SRI/FS Work Plan (ARCADIS 2010b) will also be applied to Area 3.

- Evaluate and document need for treatability studies – A summary of the potential treatability studies identified for the screened technologies was included in the *Multi-Area Feasibility Study Technical Memorandum: Evaluation of Candidate Technologies and Testing Needs* (ARCADIS 2010c). No specific treatability study

needs are identified at this time, but if such needs are identified for purposes of the Area 3 FS, a plan for testing will be submitted to USEPA for approval.

Data and other information relevant to certain scoping and characterization tasks listed above have been generated during prior investigations and documented in previously-submitted reports. These sources of data are referenced in this Area 3 SRI/FS Work Plan where appropriate. The specific data collection activities proposed to complete project scoping and characterization efforts are described in Section 5.

The SOW included as Attachment A to the SRI/FS AOC directs that new baseline human health and ecological risk assessments are to be prepared for each of the seven geographic areas of OU5. The ultimate purpose of each Area-specific risk assessment is to support Area-specific risk management and remedial decision-making. The process for developing Area-specific risk assessments was established in the RA Framework (ARCADIS 2008), which states that Area-specific risk assessment work plans will be prepared as a part of the SRI/FS process. Each Area-specific risk assessment is to build upon the information presented in the existing USEPA-approved risk assessments (CDM 2003a, b) and the Generalized CSM (ARCADIS 2009b).

Development of the Area 3 ecological risk assessment work plan may follow approval of the Area 1 (and potentially Area 2) Terrestrial Baseline Ecological Risk Assessment (TBERA), and may include a number of the key technical elements that have been approved by USEPA for Areas 1 and 2. The Area 3 ecological risk assessment will be included as an appendix to the Area 3 SRI Report.

For the human health risk assessment (HHRA), consistent with the approach taken for Area 1, the HHRA requirements for Area 3 will be met by incorporating by reference the methodology, exposure factor values, and key findings from the *Final (Revised) Baseline Human Health Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site* (BHHRA; CDM 2003b). New HHRA work undertaken for the Area 3 SRI/FS is anticipated to consist primarily of preparation of updated risk estimates for fish consumers. These updated risk estimates will be based on more recent measurements of PCB concentrations in fish tissue than the 1993 data upon which CDM relied. Given the limited scope of these new HHRA activities, a separate HHRA report will not be prepared for Area 3; instead, the updated risk estimates will be appended to and discussed within the Area 3 SRI Report.

1.3 Document Organization

The remainder of this document is organized as follows:

- Section 2 provides Study Area background information
- Section 3 describes previous investigation work
- Section 4 presents a preliminary CSM for Area 3
- Section 5 identifies data needs, data quality objectives (DQOs), supplemental investigations, and risk assessment tasks
- Section 6 identifies the planned approach for risk assessment
- Section 7 describes the overall approach for conducting the FS for Area 3
- Section 8 describes the Area 3 SRI/FS schedule
- Section 9 provides references used in preparation of this document

2. Study Area Background

Area 3, which lies between the Otsego City Dam and the Otsego Dam, includes 3.4 miles of the Kalamazoo River, its floodplain, and the currently and formerly impounded areas (see Figure 2-1). The specific Study Area boundary of the investigation area (shown on Figure 2-1) was derived from the outer extent of the Federal Emergency Management Agency (FEMA) 100-year floodplain boundary, the 683-foot (above National Geodetic Vertical Datum of 1929 [NGVD 29]) contour, and visually identified impounded areas from historical aerial photographs (see Figures 2-2a through i), in order to incorporate regions that may have been affected by historical flooding and inundation. The Study Area boundary may be reassessed in certain locations based on the results of field reconnaissance work (i.e., prior to sampling) and based on the simulated water surface elevations from the proposed hydrodynamic modeling (see Section 5.5).

2.1 Otsego Dam and Pine Creek Dam History and Current Configuration

The physical characteristics of Area 3 of the Site are influenced by the presence of a tributary – Pine Creek – and two dams – the Otsego and Pine Creek Dams. The construction and operation of these two dams have resulted in changes in this reach of the river over time. These changes in the impoundment surface area of the creek and river are shown in a series of maps and aerial photos from 1850, 1873, 1938, 1955, 1960, 1967, 1974, 1986, 1991, and 1999 in Figures 2-2a through i.

Pine Creek enters the Kalamazoo River approximately 1 mile upstream of the Otsego Dam, and its elevation is regulated by the presence of a water control structure that maintains the Pine Creek Pond (the Pine Creek Dam). When the Otsego Dam was a functioning hydroelectric facility (between 1903 and the 1960s), the impounded area of the river included a portion of the Pine Creek floodplain (see below for further detail on the history of Pine Creek).

The average bed slope in Area 3 is 2.5 feet per mile, and current average width and depth of the river in this reach is approximately 200 feet and 3.8 feet, respectively. Table 2-1 summarizes the Otsego Impoundment and Pine Creek Impoundment elevation and area data from before and after drawdown of the Otsego Dam. The histories of both dams are summarized in the following sections.

Table 2-1. Key Area 3 Impoundment Data

Parameter	Otsego Impoundment	Pine Creek Pond
Impoundment elevation (feet NGVD 29[1]) prior to Otsego Dam drawdown in 1970	683	683
Formerly Impounded length (miles) [prior to Otsego Dam drawdown in 1970]	2	-
Formerly impounded area (acres)	250	70
Current impoundment elevation (feet NGVD 29[1])	675 since 1970	685[2]
Current impounded length (miles)	1.75 since 1970	1.1- (approximate since construction of Pine Creek Dam circa 1975)
Current impounded area (acres)	67 since 1970	38 (approximate since construction of Pine Creek Dam circa 1975)
Area of currently exposed former impoundment sediments (acres)	77	-
Area of current Kalamazoo River channel within Area 3 river reach (acres)	83	-

Notes:
1. NGVD 29 - National Geodetic Vertical Datum of 1929
2. Pine Creek water surface elevation estimated from recent topographic survey from 2010 (see Section 3.4.1)
3. The formerly impounded area for Area 3 is identified as the area within the Study Area boundary and is approximately 250 acres, excluding the Pine Creek area. Including the Pine Creek area, the Study Area is 320 acres.

2.1.1 Otsego Dam

Construction of the Otsego Dam began in 1902, and when it was initially completed in 1903, it was used to generate hydroelectric power for the town of Otsego (Dalrymple 1983, Rachol et al. 2005). The dam was destroyed in 1903 by a large flood and was rebuilt in 1904 (Dalrymple 1983). Following the reconstruction, the dam continued to be used for hydroelectric power generation until 1960 (Rachol et al. 2005). Over the years, the dam has undergone various changes. The downstream pile-supported reinforced concrete apron was added to the spillway in 1917, and in 1925, the powerhouse structure was reconstructed and new generators were installed. These generators were removed from the powerhouse structure in 1965 (CDM 1999).

In 1970, the Michigan Department of Natural Resources (MDNR) raised and jammed the spillway gates in the open position to lower the upstream impoundment to the fixed weir level (CDM 1999). The records regarding removal of spillway control gate and support members, spillway, catwalk, and powerhouse are unclear, stating that these structures may have been dismantled during a military training exercise in 1975 or by a contractor in 1985 (CDM 1999). The drawdown and dismantling of the dam lowered water levels by approximately 10 feet (ARCADIS 2008). Before the dam was drawn down, the water elevation in the Otsego Dam was approximately 683 feet (NGVD 29). Currently, the water elevation behind the dam is approximately 675 feet and the impounded area (excluding Pine Creek) is approximately 67 acres (CDM 1999).

Currently, the Otsego Dam consists of a 170-foot left earthen embankment, 128-foot concrete spillway, 135-foot center earthen section, 110-foot former concrete hydroelectric generation section, and 157-foot right earthen embankment. This gives a total structure length of 700 feet (See Figure 2-1) (Soil and Materials Engineers, Inc. [SME] 2008). The spillway capacity at the 10-year flood stage is 3840 cubic feet per second. The hydraulic head and the freeboard of the dam are 5 feet and 3 feet, respectively. In its current configuration, the dam has a structural height of 21 feet and a hydraulic height of 18 feet (SME 2008). The area of the current Kalamazoo River channel throughout all of Area 3 is approximately 83 acres.

2.1.2 Pine Creek

The Pine Creek Pond, located on the southern side of the river, was part of the area impounded when the Otsego Dam was functioning (see Figures 2-2a through i). It flows into the Kalamazoo River approximately one mile upstream of the Otsego Dam. Review of a map from 1873 (Rumsey 2010) indicates that Jefferson Road (M-89) existed prior to construction of the Otsego Dam. After the generators were removed from the Otsego Dam in 1965 and the stoplogs were raised in 1970 (CDM 1999), the upstream water levels dropped and caused drainage of the Pine Creek Pond, turning the pond into a “small swampy section” (Dalrymple 1983). The water level in the pond was restored in either 1973 (National Inventory of Dams; U.S. Army Corps of Engineers (USACE) 2011) or 1975 (Dalrymple 1983) when a new bridge and the Pine Creek Dam were built across Pine Creek at Jefferson Road (see Figure 2-1). No definitive records are available for the previous Pine Creek Pond elevation.

The Pine Creek Pond is currently impounded by a small control structure (Pine Creek Dam), which includes a culvert that provides a hydraulic connection between the

pond and the Kalamazoo River. The Pine Creek Dam maintains an impounded surface water area of approximately 38 acres (National Inventory of Dams 2011). The structural height of the dam is approximately 17 feet.

The Pine Creek Impoundment has historically been drawn down on at least two occasions to flush out sediment, manage wetland vegetation and control exotic plants (Bailey 2000 and Rachol et al. 2005). The first reported drawdown of the impoundment was conducted in 1993 (BBL 2000b). In June 2000, the Pine Creek Pond was reportedly dewatered for a duration of five days (Rininger 2000). Observations (noted by Rachol et al. 2005) indicate that the previous water levels were reestablished following this sediment removal. More specific information concerning of the history and dates of drawdown events or volume of sediment that may have been flushed out by such events was not available during development of this Area 3 SRI/FS Work Plan.

The top of the sediment in Pine Creek Pond is currently 4 to 9 feet higher than top of sediment elevation in the Kalamazoo River at the discharge point (see Figure 2-1). The 2010 topographic survey (see Section 3.4.1) of the former Otsego Impoundment indicates that the crest of Jefferson Road is at an approximate elevation of 689 feet (NGVD 29) along the stretch of M-89 to the Pine Creek Dam.

2.2 Constituents of Concern

The Site-wide database includes thousands of sample results from analyses of river sediments; floodplain soils; exposed sediments in the former Plainwell, Otsego City, Otsego, and Trowbridge Impoundments[1]; surface water; and biota, particularly fish. Samples have been assessed for a variety of constituents, but the available data indicate that potential exposure to PCBs is the key driver of potential risks at the Site. The available Site-wide data for non-PCB constituents were reviewed as part of SRI activities for Area 1 (ARCADIS 2011), and the conclusions of that data screening process were that basing the risk assessment and decision-making process on PCBs will address areas of elevated concentrations of many other constituents that have accumulated in areas of fine-grained sediment deposits. Sampling is currently underway in Area 2 to evaluate the extent of non-PCB constituent contamination and

[1] A note on terminology, the sediments that were exposed as a result of water levels dropping when dams were opened or partially removed are referred to as exposed sediments, the soils that comprise the natural floodplains are referred to as floodplain soils.

confirm the conclusions from the data screening presented in the Area 1 SRI Report (ARCADIS 2011).

As a result, the key focus of this Area 3 SRI/FS Work Plan is on PCBs; however, other constituents may also be assessed as detailed in Section 5.2. The extent of this work will in part be determined by outcomes of ongoing work in Area 2.

2.3 Physical Characteristics of Area 3 Sediments, Floodplain, and River Banks

The United States Geological Survey (USGS) (Rheaume et al. 2002) provides a description of two types of sediment deposits located within the former Otsego Impoundment. Due to an increase in the water levels after construction of the Otsego Dam, lacustrine material deposited in the impoundment. Lacustrine deposits in the former Otsego Impoundment consisted of interbedded, organic-rich silt and clay, fine to medium sand, and some gravel with thickness ranging from 0 to 12 feet prior to removal of the dam superstructure.

After the dam superstructure was removed and water levels lowered (see Section 2.1), new channels were cut through the lacustrine deposits resulting in erosion, transport, and redistribution of the sediment. When these channels stabilized, alluvial material deposited over the remaining lacustrine deposits. These coarser-grained deposits are related to an increase in the slope and water velocity. USGS also found the presence of coarse pre-dam alluvium deposits upstream of the dam foundation (Rheaume et al. 2002). Alluvium deposits are mostly sand and gravel with traces of silt and clay and range in thickness from 1 to 5.5 feet.

Total in-stream sediment volume (including post-superstructure alluvium and historical lacustrine deposits) in the former Otsego Impoundment is estimated by USGS as approximately 268,900 cubic yards (cy). The sediment thickness ranges from 0 to 14 feet with an average thickness of 5.7 feet over a 1,400,100 square foot (32 acre) surface area. USGS reported that approximately 66% of the sediment deposits are in the middle one third of the former impoundment (Rheaume et al. 2002).

The average thickness of exposed sediment (i.e., current floodplain soils that were underwater prior to the drawdown of the Otsego Dam) is 4.4 feet. The volume of the exposed sediments is approximately 540,000 cy, extending over a total estimated area of 77 acres and containing a total PCB mass of approximately 6,300 kilograms

(kg). Figures 2-3a and 2-3b show the top of sediment elevation and Figures 2-4a and 2-4 b show the sediment thickness.

The opening of the Otsego Dam in 1970 and the subsequent partial removal of the dam structures in 1975 or 1985 caused a rapid increase in river velocities and gradient, which resulted in the erosion, transport, and redistribution of sediment deposited in the downstream portion of the impoundment (Rheaume et al. 2002; Blasland, Bouck & Lee, Inc. [BBL] 2000a). According to the USGS study, approximately 4 feet of the lacustrine deposits eroded following the dam superstructure removal (Rheaume et al. 2002). To evaluate the bank stability/erodibility and PCB loading for the former Otsego Impoundment, a survey was conducted in 2000 as described in further detail in Section 3.

2.4 Property Ownership and Adjoining Areas

A Land Use Assessment will be completed and included in the Area 3 SRI/FS Report. The assessment may include recording uses observed in specific locations within the Study Area. Current land ownership information is summarized in the following sections.

2.4.1 Ownership of the Dams

The Otsego Dam was owned by Consumers Power Company until 1965, when ownership was transferred to MDNR, the current owner (CDM 2010). Pine Creek Dam is currently owned by the Pine Creek Lake Level District.

2.4.2 Parcel Ownership

The Allegan County parcel database was reviewed to identify parcel ownership in Area 3. Parcel ownership information as indicated by the Allegan County parcel database is shown in Figures 2-5a and 2-5b. As indicated in Figures 2-5a and 2-5b, MDNR (shown in blue shading) and the City of Otsego (shown in brown shading) are the primary land owners in Area 3. The land between parcel boundary lines and the shoreline where no property record is available (one instance is the land directly to the north of Pine Creek) is assumed to be owned by MDNR.

3. Previous Remedial Investigation and Subsequent Studies Prior to the SRI

Area 3 has been the subject of a number of prior investigations and studies which are summarized in the following subsections.

3.1 PCB Investigations in Area 3

Prior sampling to characterize the nature and extent of PCBs in Area 3 includes sampling events in 1993, 1994, and 2000. These events included sediment and floodplain soil sampling and are briefly described below.

- **1993/1994 RI Sediment Investigation (KRSG)** – A sediment investigation was conducted in Area 3 between 1993 and 1994 as part of the Site-wide RI; however, the cores were frozen and not analyzed until 1997. Sediment was probed at 102 locations along 15 transects, and sediment cores were collected at 67 locations throughout Area 3 to characterize sediment distribution and composition. In 1997, 37 of the sediment cores, representing both fine and coarse material (see Figure 3-1), were segmented and analyzed for PCB Aroclors. As part of this effort, selected samples were also analyzed for particle size, Target Compound List/Target Analyte List (TCL/TAL) analytes, and/or total organic carbon (TOC).

- **1993/1994 RI Floodplain Soil Investigation (KRSG)** – In 1993, eight soil cores were collected along a single floodplain transect in Area 3. The transect extended from the edge of the river through the former impoundment exposed sediment, and, by design, up the bank to an elevation above the estimated 100-year flood elevation. Samples obtained from each core location were analyzed for PCB Aroclors and TOC.

- **1993/1994 Former Impoundment Sediment Investigation (KRSG)** – During the 1993/1994 former impoundment investigation, samples were collected from six transects in the former Otsego Impoundment to assess the distribution of PCB-containing sediment and other constituents of concern. Exposed sediment and floodplain soil samples were collected from approximately seven core locations along each transect perpendicular to the river channel, and extending from the river bank to the edge of the 100-year floodplain. Samples from those soil cores were analyzed for PCB Aroclors and TOC.

- **2000 Supplemental Investigation Sediment Sampling (KRSG)** – Sediment cores were collected from 29 locations within Area 3, generally overlapping with locations

of cores collected in the 1993 RI sampling effort (see Figure 3-1). Samples from the upper one-foot of each core (typically 0-2, 2-6, and 6-12 inch intervals) were analyzed for PCB Aroclors. Selected samples were also analyzed for PCB congeners (analyzed by Severn Trent Laboratories, now TestAmerica Laboratories), particle size, percent moisture, and/or TOC. This sampling was conducted to provide an updated assessment of PCB distribution in the Kalamazoo River sediment compared to the 1993/1994 RI work.

- **Additional PCB Investigations –** Additional PCB sampling performed in Area 3 includes:

  - 1993 Terrestrial Biota Investigation, which included the collection of two soil samples from within Area 3. Those samples were both composite samples of eight individual one-foot cores collected from grids established at two locations within the former impoundment. Soil samples were analyzed for PCBs and percent solids.

  - 1993/1994 Source Investigation Sampling Program, which was initialized as a result of research into identification of potential sources of PCBs to the Site. A sampling program was developed to collect sediment in the vicinity of a number of outfalls, with a total of five cores located in Area 3. Two sediment cores each were collected near the Parker Hannifin outfall in the City of Otsego and three cores from downstream of the Rock-Tenn outfall, also located in the City of Otsego.

  - 2000 Geochronological Investigation, which included sampling at two locations within the former Otsego Impoundment. These cores were finely segmented for radiodating, and samples from one of the cores were analyzed for PCBs (ODG-1).

  - 2000 Focused Sampling Program, designed by MDEQ and carried out from April through August 2000, included collection of soil and sediment samples from locations specifically selected by MDEQ to characterize or further characterize known and suspected PCB point sources and historical waste disposal areas, areas of suspected fine-grained sediment deposition within the Kalamazoo River and the floodplains. The focused sampling included four floodplain soil cores from within Area 3 and one sediment core located within the Pine Creek Pond. These cores produced 12 floodplain soil and six sediment samples for PCB analyses.

- Surface water sampling was performed by ARCADIS at the Farmer Street Bridge (in the upper portion of Area 3) as part of the 1993/1994 RI, and again as part of supplemental investigations in 2000/2001. During the two investigations, a total of 38 and 41 surface water samples, respectively, were gathered. Also in 2000, 3 surface water samples were collected just upstream of the Otsego Dam. In addition, between 2007 and 2009, a total of 191 surface water samples were collected at Farmer Street as part of the monitoring conducted during the time-critical removal action (TCRA) implemented in the former Plainwell Impoundment. Samples were analyzed for PCBs and total suspended solids (TSS). Surface water samples have also been collected by MDEQ from the Farmer Street Bridge location, with limited additional sampling at the Otsego Dam location, as part of the long-term monitoring program. Samples were first collected during wet and dry weather events in 1999 and 2000, and sampling has been conducted approximately once a quarter since 2003.

- In July 2000, the MDEQ (CDM) collected soil and vegetable samples (i.e., carrots, pepper, green tomato, potato, and rhubarb) from a garden cultivated within the floodplain of the former Otsego City impoundment on State land. Soil and vegetable samples were collected from three different areas within the garden: west, middle, and east. One soil core was collected from the east area of the garden and the 0-2 inch and 2-9 inch intervals were sampled. In addition, one soil sample was collected from a garden behind a house at 305 First Avenue and another soil sample was collected from an area near a drained high flow channel, where gray material was suspected to be present. Soil samples were analyzed for total PCBs and TOC. Additional vegetable samples, which included horseradish, cucumber, and lettuce, were collected after the initial sampling. Vegetable samples were analyzed for total PCBs only. A total of eight soil samples were collected from the various areas using hand auger, coring, or surface grab sampling. Vegetable samples were collected as grab samples from the garden area and a selected portion were submitted for analysis. Analytical results indicated that total PCBs in collected soils ranged from 0.33 milligrams per kilogram (mg/kg) to 17 mg/kg. The maximum soil PCB result (17 mg/kg) was collected from the middle garden and the minimum value was collected from the residence on First Avenue. The vegetable samples contained total PCB concentrations that ranged from 0.0032 mg/kg to 0.069 mg/kg. In August 2000, the MDEQ wrote a letter advising the gardener to abandon the garden, expressing concern due to the presence of PCBs.

- Fish tissue PCB samples have been collected intermittently in Area 3 since the 1980s and long-term records are available for certain species, in particular smallmouth bass and carp. Data that MDEQ collected within the impoundment in 2011 will be made available in summer 2012 and will be considered in the development of the Area 3 SRI Report.

PCB data for the soil and sediment samples collected by KRSG are summarized in Table 3-1 (below) by investigation, along with a USEPA usability designation for each of the datasets. Tables 3-2 and 3-3 provide a complete summary of the data collected by KRSG and MDEQ for Area 3. Data for all media will be summarized in the Area 3 SRI Report; however, as the primary focus of supplemental work in Area 3 is expected to be on surveying and sampling soils and sediments, only those data are summarized below. Figures 3-2 and 3-3 show the existing surface PCB results and core-maximum PCB results, respectively, for floodplain soil and sediment sample locations in Area 3. Maps showing a data box with the PCB results for each available sample by depth interval are provided in Appendix A.

Table 3-1. Summary of Existing KRSG PCB Soil and Sediment Samples in Area 3

Sampling Event	Total Number of Locations	Total Number of PCB Samples Analyzed	USEPA Usability Designation for Dataset[2, 3]
Floodplain Soil			
1993 Floodplain Investigation	8	17 (+2 duplicates)	1
1993/1994 Former Impoundment Sediment Investigation	41	150 (+15 duplicates)	1
1993 Terrestrial Biota Investigation	2	2 (+1 duplicate)	1
2000 SRI Focused Sediment Sampling	4	12 (+3 duplicates)	2
Total	**55**	**181 (+21 duplicates)**	
Sediment			
1993/1994 Sediment Investigation	37	129 (+17 duplicates)	1
1993/1994 Sediment Source Investigation	5	16 (+2 duplicates)	2
2000 SRI Morrow Dam to Lake Allegan Dam Sediment Sampling	29	80 (+9 duplicates)	4
2000 SRI Focused Sediment Sampling[1]	1	6	2
2000 Geochronological Investigation	1	24 (+3 duplicates)	4
Total	**73**	**255 (+31 duplicates)**	

Notes:
1 This sampling location (FF-66) was located in the Pine Creek Pond.
2. Categories 1 and 2 – Data collected following an accepted administrative approval and oversight process. It is not required that these be flagged in the database or in report tables or figures with respect to data usability.
3. Category 4 – Data collected consistent with an approved QAPP and SOPs in place at the time, but without following an accepted administrative review/approval process or with field oversight. These data may be included as supplemental information with a proper flag, and when used in evaluations or reports, a brief description of the limitations should be included. These data will be flagged as follows: "Data collected without agency review or approval of work plans or field oversight."

3.2 Summary of Existing Sediment and Soil PCB Data

A statistical summary of the PCB concentration data by sample type (sediment or soil) and sediment grain size (fine or coarse) is provided in Table 3-4. The soil data from the 1993 Terrestrial Biota Investigation, and sediment data from the 1993/1994 Sediment Source Investigation, 2000 Geochronological Investigation, and 2000 Focused Sampling Program core collected in Pine Creek[2], are not included in any of the statistical analyses presented in this section, as the depth intervals analyzed as part of

[2] FF-66 was collected in the northwest corner of Pine Creek in 2000 (just south of Jefferson Road) as part of the Focused Sampling Program. PCBs were detected between 2 and 24 inches, with a maximum concentration of 16 mg/kg (estimated) in the 6 to 12 inch depth interval. The Pine Creek Study Area has been identified separately from the Area 3 Study Area Boundary; therefore, this sample is treated separately in Table 3-4.

these studies were not consistent with those of the primary PCB investigations, and particle size information is not available for all samples. However, all available data will be presented and relevant data will be used to define nature and extent in the Area 3 SRI report.

Cumulative frequency plots of sediment and soil PCB data are shown in Figures 3-4 through 3-6. In general, PCB levels were higher in the exposed sediment (sediments that were exposed after drawdown of the dam and lie between the shoreline of the Kalamazoo River and the former impoundment elevation of 683 feet NGVD 29) of the former Otsego Impoundment (BBL 2000a) than in the present day sediment.

A total of 209 sediment samples have been collected from 66 locations within Area 3, excluding those samples collected as part of the additional PCB investigations (as discussed above). Of these samples, 32% (67 samples) did not contain PCBs at detectable concentrations. Approximately 86% (180 samples) of all sediment samples exhibited PCB concentrations less than 1.0 mg/kg (see Figure 3-4). Approximately 2% (4 samples) of sediment samples exhibited PCB concentrations above 10 mg/kg.

The distributions of PCB concentrations in fine- and coarse-grained sediment samples, as shown in Figure 3-5, indicate that all existing PCB concentrations above 10 mg/kg were found in fine-grained surface and subsurface sediments. Approximately 90% of coarse-grained sediment samples exhibited PCB concentrations below 1.0 mg/kg, compared to only 70% of fine-grained sediment samples that fall below this concentration.

The approximate density of existing sediment cores within the Kalamazoo River channel is 0.80 cores per acre (65 samples over a total water surface area of 83 acres). The approximate density of existing cores within the formerly impounded area of the Kalamazoo River in Area 3 is 0.44 cores per acre (34 samples over a total exposed sediment area of 77 acres).

Approximately 90% of the floodplain soil samples outside the 683-foot contour (former impoundment elevation) have PCB concentrations less than 1 mg/kg. One sample located outside the former impoundment elevation (OES3-7) in the floodplain alongside Jefferson Road resulted in a PCB concentration of 9.3 mg/kg. The median PCB concentration of all soil samples (exposed sediment and floodplain soils) in Area 3 is 1.9 mg/kg (see Figure 3-6), compared to the median surface soil concentration of 2.2 mg/kg. Approximately 62% of all soil results are below 5 mg/kg; and PCB

concentrations in approximately 43% (23 samples) of surface and 42% (53 samples) of subsurface samples are below 1 mg/kg.

3.3 Available Non-PCB Data

Data for constituents other than PCBs available for Area 3 media are presented in Appendix B. These include TCL/TAL results from one sediment core (KPT92-7) collected by BBL in 1993 and analyzed in 1997, one sediment core (USGS-2) collected by MDEQ in 2000, one floodplain soil core (KF4-4 collected in 1993), one exposed sediment core (OES6-5 collected in 1994), and one surface water sample (SWK-4) collected by BBL in 1994. Thirty-three fish samples collected in 1993 from within the former impoundment area (K40268F through K40282F, K40284F through K40290F, and K40291W through K40301W) were analyzed for pesticides and mercury. Dioxin/furan data are available for four fish samples collected as part of the Aquatic Biota Investigation by KRSG in 1993 and the Michigan Fish Contaminant Monitoring Program by the State in 2001.

3.4 Other Prior Data Collection and Studies

3.4.1 Bathymetry and Floodplain Topography Surveys

Available river bathymetry and floodplain topography data within Area 3 are summarized below.

- In 1993, 15 transects were established between the Otsego City Dam and the Otsego Dam for sediment characterization. Along these 15 transects, sediment was probed at 102 locations and cores were collected at 67 locations for evaluation of the particle size distribution in Area 3. These sediment cores were visually classified as either fine- or coarse-grained material. During the 1993/1994 RI work, measurements of water depth, water velocity, and sediment thickness were also recorded.

- In 2000, USGS completed a study of sediment characteristics and configuration within the former Otsego Impoundment (Rheaume et. al. 2002), which included measurements and samples collected along 12 transects upstream of the Otsego Dam. Measurements of water depth, water velocity, and sediment thickness were made at 15 or 16 locations along each transect. Additionally, a total of 12 sediment cores (one at each transect) were collected and described, and representative samples were sent to a laboratory for analysis of particle size distribution.

- In November 2000, a bathymetric survey and side-scan sonar survey were conducted by Ocean Surveys Inc. (OSI) in the lower portions of Area 3. The maps and data obtained from this survey are included in Appendix C. These data provide partial bathymetry of the former impoundment as well some insight to the nature of the sediment surface, and were used in the development of the top of sediment elevations presented in Figures 2-3a and 2-3b.

- In 2000, erosion pins were installed along transects at 10 locations in the former Otsego Impoundment to measure changes in the bank over time and estimate the rate of erosion, where observed. Erosion pins were established in 2000 and monitored twice a year through 2002 to document periodic changes in the bank that occurred during that time. Data and bank profiles from the erosion pin survey are provided in Appendix D.

- In March 2010, an aerial photogrammetric survey of Area 3 was performed by Axis Geospatial at the request of ARCADIS to develop updated orthographic aerial images and detailed topographic information (1-foot contours) for the impoundment and surrounding locations (image and topographic maps are provided in Appendix E). Shaded contour intervals prepared from the March 2010 data are shown in Figures 3-2 and 3-3.

- MDEQ performed a bathymetric survey in Area 3 in 2011, however the data from this effort have not yet been finalized. These bathymetric data will be included, when available and as applicable, in the development of the Area 3-specific sampling plan and the Area 3 SRI Report.

3.4.2 Hydraulic Models

Three one-dimensional (1-D) computer models have been constructed describing the hydrology, sediment, and/or banks of the Kalamazoo River between the Otsego City Dam and the Otsego Dam (Syed et al. 2004; Rachol et al. 2005; Wells et al. 2007). These include applications of sediment transport model (SEDMOD) to model sediment transport, the CONCEPTS model to simulate bank erosion and stability, and a Hydrologic Engineering Center River Analysis System (HEC-RAS) hydraulic model to model water velocity and elevation. USGS has provided ARCADIS with copies of each of these models. Modeling work is briefly described below.

- Syed et al. (2004) presents the results of a 1-D SEDMOD describing the sediment load and estimated volume of sediment erosion/deposition between the former

Plainwell Dam and the Trowbridge Dam assuming both existing conditions and after removal of four Kalamazoo River dams (i.e., former Plainwell Dam, Otsego City Dam, Otsego Dam, and Trowbridge Dam).

- Rachol et al. (2005) presents a suite of model results, including the HEC-RAS model, SEDMOD, and the Agricultural Research Station Bank Stability Model, for a portion of Area 3 (1.8 miles downstream of the Otsego City Dam).

- The work of Wells et al. (2007) is similar to that of Rachol et al. (2005) (1.8 miles downstream of the Otsego City Dam). Similar channel geometry was used to determine pre- and post-dam removal sediment dynamics. However, Wells et al. (2007) used the CONCEPTS model, which incorporates bank stability and sediment transport into a single modeling framework and was run over a 37-year time frame compared to a 730-day time span assessed by Rachol et al. (2005).

- MDNR is currently performing a feasibility study and dam removal design for the Otsego Dam and as part of this effort will be developing a hydraulic model. This model may be incorporated, if and when available, in the development of the hydraulic model described below.

3.4.3 Geotechnical Borings

A total of 11 sediment cores were collected in the former Otsego Impoundment during the fall of 2000 and analyzed for geotechnical characteristics. Sampling locations targeted only fine-grained or mixed sediment and cores were collected and analyzed for Atterberg Limits, organic content, particle size distribution, moisture content, and dry bulk density. Additionally, *in situ* vane shear tests were conducted at specified depth intervals adjacent to the core samples locations.

3.4.4 Wetland Evaluation

In 1993, six wetlands – identified as either palustrine emergent or palustrine forested wetlands and covering an area of approximately 37 acres – were indicated on the National Wetland Inventory map of the former Otsego Impoundment presented in the 2000 RI (BBL 2000a). A copy of this map as presented in the 2000 RI is provided in Appendix F. Based on those maps, a wetland evaluation was conducted in the former Otsego Impoundment in 1993 using the WET model (as developed by USACE) to locate wetlands, identify their physical and chemical characteristics, evaluate their

functions and values, and assess their habitat quality. Wetlands will be evaluated and surveyed during the proposed reconnaissance phase to reconfirm boundaries.

The results of the WET model indicated high effectiveness rankings for groundwater discharge, sediment/toxicant retention, nutrient removal/transformation, wildlife breeding and migration, and aquatic diversity/abundance. The high ranking for groundwater discharge signifies a large drainage basin and a location low in the regional topography. The high rankings for sediment/toxicant retention and nutrient removal/transformation indicate that a high percentage of wetland vegetation is in contact with surface water and that there are contaminants and/or excessive nutrients present in the water/river system. In addition, a diversity of wetland habitat types in proximity to open water and open field was indicated by high rankings for wildlife breeding and migration, and aquatic diversity/abundance (BBL 2000a, BBL 2000b).

3.4.5 Habitat Assessment

In 1993, a generalized habitat assessment was completed for the former Otsego Impoundment wetlands. This evaluation was conducted to estimate the suitability of wetlands as habitat based on the habitat characteristics and previous research. The wetland evaluation suggested that the former Otsego Impoundment provided a rural setting and a large area of available wildlife habitat. Thus, this area was rated high for wildlife migration. The habitat assessment concluded that the former Otsego Impoundment was fairly conducive to use by great horned and barred owls. These owls could adequately use the extent of forest habitat and the density of the canopy for roosting and foraging (BBL 2000a).

An ecological and habitat characterization assessment was completed in 2000 by ARCADIS (on behalf of the KRSG) to identify existing ecological conditions and to evaluate potential impacts of remedial activities (BBL 2000b). The findings of this analysis can be used to summarize the general habitat types in Area 3. This assessment included a reconnaissance-level field habitat survey of terrestrial and aquatic habitat and biota. The assessment indicated that emergent and scrub-shrub wetlands comprise the majority of riparian habitat in Area 3. In addition, in 2002 CDM conducted a wetland delineation study to review existing data and to confirm the approximate wetland boundary within a portion of the Kalamazoo River and Portage Creek floodplains (CDM 2002), including Area 3.

High resolution aerial photographs of this area taken in 2010 provide additional information concerning current habitat conditions in Area 3. The habitat information

from the 1993 and 2000 evaluations, CDM's 2002 delineation, and the 2010 aerial photographs, along with other relevant results, will be used to guide ecological risk assessment considerations, and will be included in the Area 3 SRI Report.

3.4.6 Ecological Risk Studies

Previous ecological risk studies for the Site as a whole include the *Final (Revised) Baseline Ecological Risk Assessment* (Site-Wide BERA) conducted by CDM on behalf of the State of Michigan (CDM 2003a), and a three-year series of supplemental field studies carried out by staff from the Michigan State University's Aquatic Toxicology Laboratory - Department of Zoology and the National Food Safety and Toxicology Center under the direction of Dr. John Giesy on behalf of the KRSG. Data from these studies are useful for evaluating risks in Area 3; however, no ecological sampling stations were located within Area 3.

4. Preliminary Area 3 Conceptual Site Model

As required by the SOW, an Area-specific CSM is included in this Area 3 SRI/FS Work Plan. The Generalized CSM (ARCADIS 2009b) provides an overall description of key aspects of OU5 (the Kalamazoo River and a section of Portage Creek, and associated floodplains), and the RA Framework (ARCADIS 2008) describes general exposure pathways and receptors for the Site. This Area 3-specific CSM, which is based on information described in earlier sections of this Work Plan, provides more detail with respect to the distribution and fate and transport of PCBs in Area 3 and presents the complete exposure pathways for human and ecological receptors that will be evaluated in the SRI process. This preliminary Area 3 CSM will be updated and expanded in the Area 3 SRI Report.

4.1 Geomorphic Features

The former Otsego Impoundment is the downstream section of Area 3, below the former Otsego Dam pool elevation of 683 feet (NGVD 29), and when the dam was in operation, the impounded area is estimated to have extended approximately 2 miles upstream of the dam, just 0.25 mile further than the current extent of backwater (Rachol et al. 2005). The upstream end of Area 3 was not impacted by the Otsego Dam and is free-flowing. Currently, the remnants of Otsego Dam maintain an impounded water elevation of approximately 675 feet (NGVD 29). Over a period of years, the Kalamazoo River flow path in the formerly impounded area has changed due to dam construction and dam structure removal, becoming more channelized through the central portion of the impoundment just downstream of the old bridge crossing to the north of Pine Creek (changes are illustrated over time in historical aerial photographs presented in Figures 2-2a through i).

PCB distributions within the formerly impounded section of Area 3 are influenced by the historical geomorphology and sediment erosion, transport, and deposition mechanisms. PCBs adsorb to a greater extent to finer sediment with higher TOC content, and as a result tend to accumulate where finer sediment deposits and accumulates. Historically in Area 3, fine-grained sediment deposited in the impounded low-velocity environment behind the dam. In the upstream free-flowing section, higher velocities limited deposition of fine sediment and the sediment is generally coarser. There is also a general tendency for fine sediments to deposit at channel margins. After the draw-down of the Otsego Dam, water levels dropped, sediment deposits that were once submerged were exposed, and the lowered channel incised into the former sediment bed. Available data indicate that the uppermost layers of floodplain soils have the

highest PCB concentrations. Additionally, PCB concentrations in floodplain soils tend to decrease with distance from the current river channel (see Section 4.2).

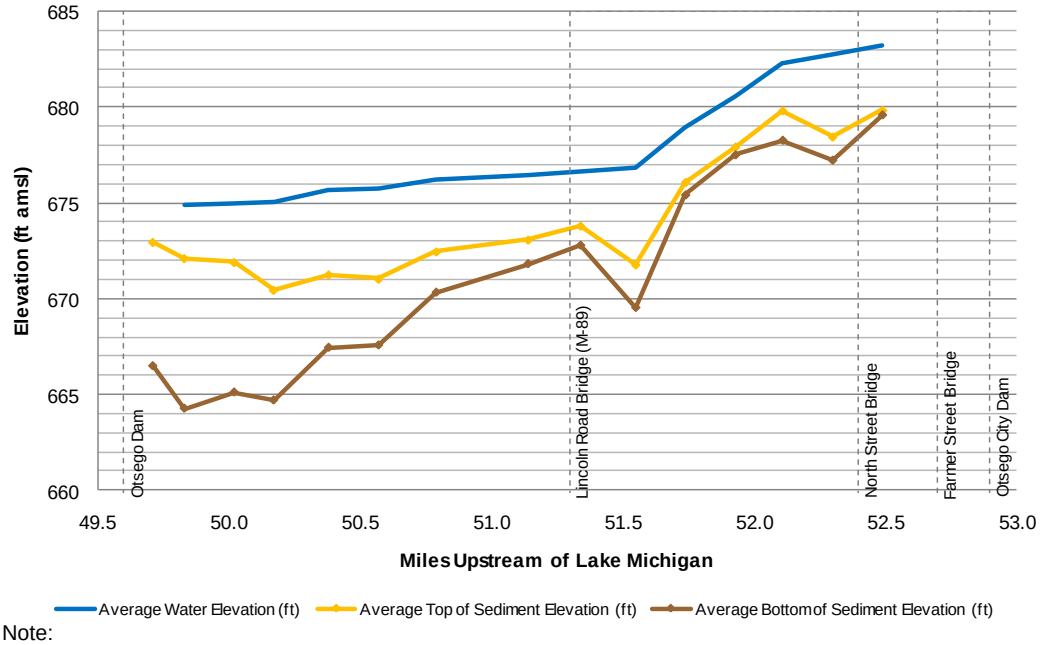
Pine Creek was once a former backwater area of the Otsego Dam, but the construction and enhancement of the Pine Creek Dam in the early 1970s created Pine Creek Pond, a separate impoundment. To date only one sediment core sample has been collected within the Pine Creek Pond – additional samples will be collected from the pond during the supplemental investigation in Area 3.

4.2 PCBs in Sediments and Soils

4.2.1 PCBs in In-Stream Sediment

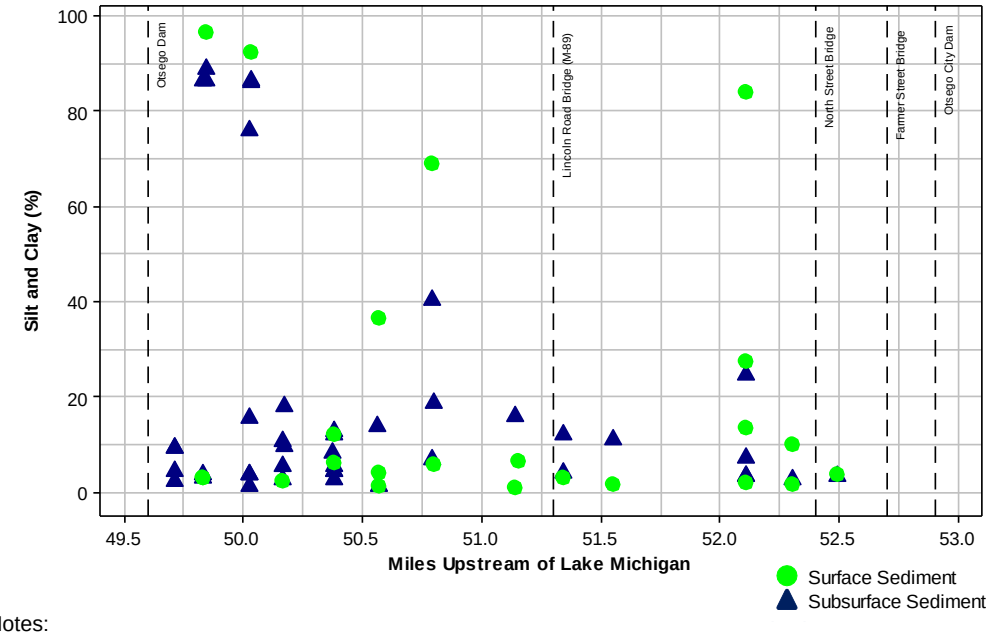
Figures 4-1 through 4-4 show sediment elevations, percent fine material, PCB concentrations, and TOC by River Mile upstream of Lake Michigan.

Figure 4-1. Average Sediment Elevation (by transect) in Area 3



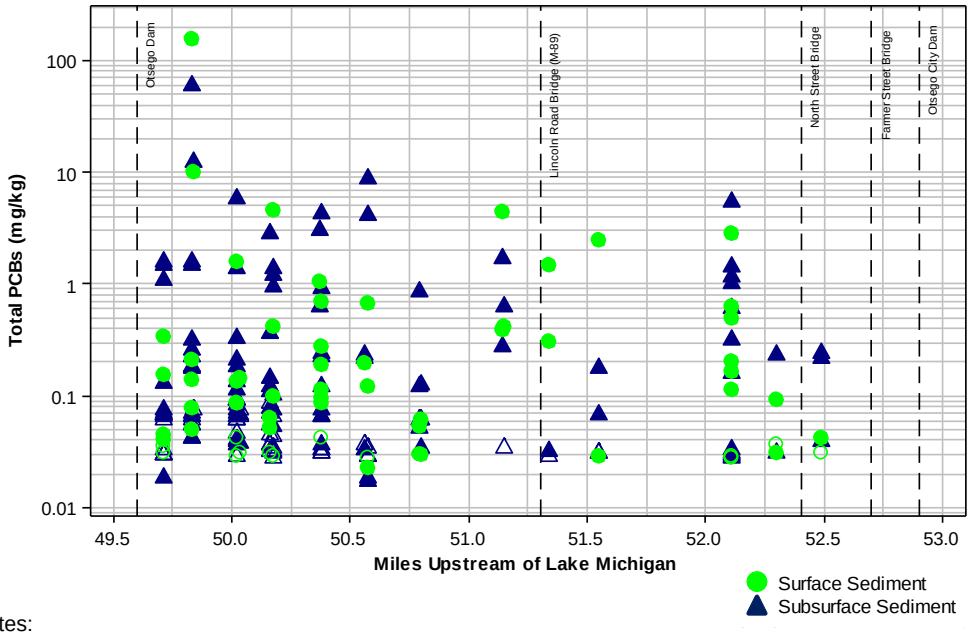
Note:
Surface water elevations based on water depth measurements collected at transects KPT80 through KPT94 during RI activities between 9/22/1993 and 10/6/1993. Figure does not show water surface elevation results for KPT86 or KPT94 as they result in an anomalous water surface profile.

Figure 4-2. Silt and Clay in Surface and Subsurface Sediment in Area 3



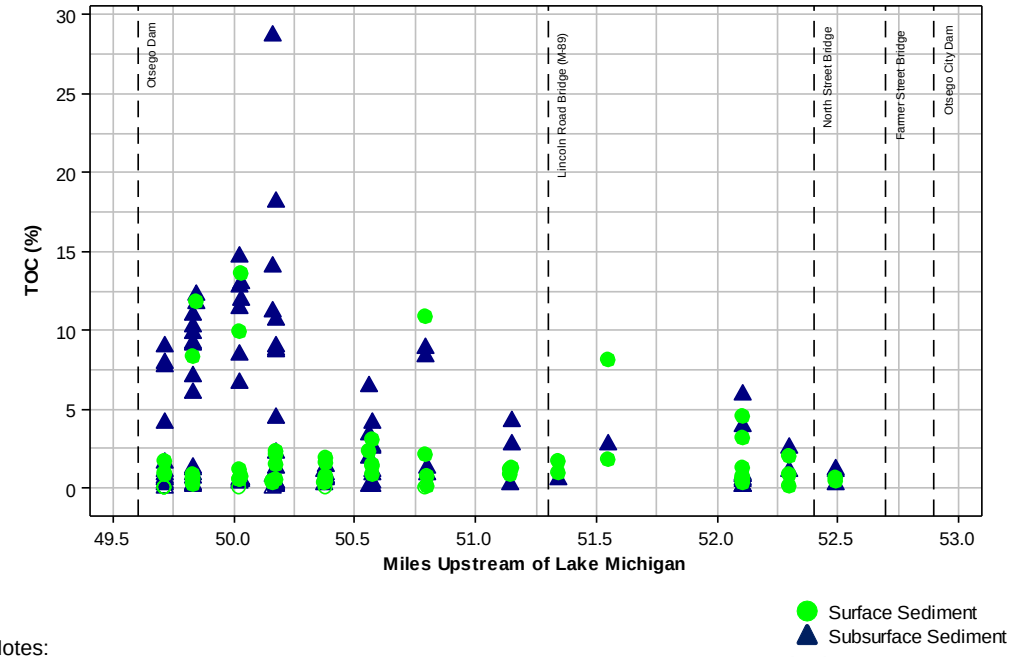
Notes:
1. Parent/duplicate samples were averaged.
2. Includes data collected during the 1993/1994 RI and 2000 supplemental RI sediment sampling investigations.

Figure 4-3. Total PCBs in Surface and Subsurface Sediment in Area 3



Notes:
1. Parent/duplicate samples were averaged.
2. Includes data collected during the 1993/1994 RI and 2000 supplemental RI sediment sampling investigations.
3. Open symbol indicates non-detect result (plotted at ½ the detection limit).
4. Closed symbol indicates detected result.

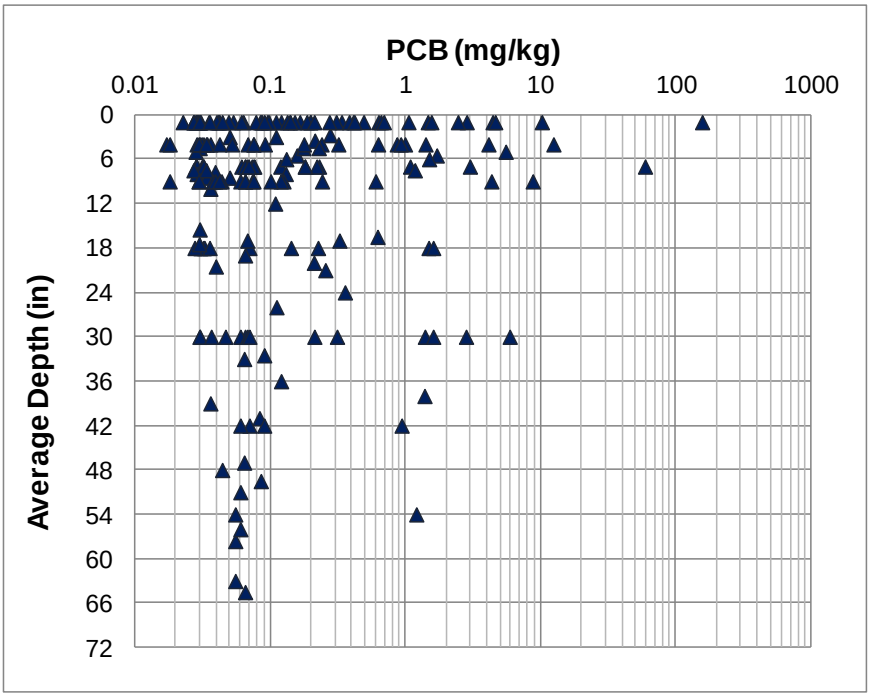
Figure 4-4. TOC in Surface and Subsurface Sediment in Area 3



Notes:
1. Parent/duplicate samples were averaged.
2. Includes data collected during the 1993/1994 RI and 2000 supplemental RI sediment sampling investigations.
3. Open symbol indicates non-detect result (plotted at ½ the detection limit).
4. Closed symbol indicates detected result.

PCB concentrations in in-stream sediments range from non-detect to a maximum of 160 mg/kg, which occurred at the surface (0-2 inches) of sediment core KPT93-1 near the southern bank approximately 1380 feet upstream of the Otsego Dam (see Table 3-4 and the databox figure presented in Appendix A). The average PCB concentration for all in-stream sediments (across all depths) is 1.6 mg/kg (in this average, non-detect results were assigned a value of one-half the detection level). This average increases to 4.5 mg/kg when only fine-grained sediments are included. Relative PCB concentrations in the former Otsego Impoundment from both the 1993/1994 RI and the 2000 supplemental sediment investigation are shown in Figures 3-2 (surface sediment PCB concentrations) and 3-3 (maximum sediment PCB concentrations). Additionally, Figure 4-5, below, indicates the relationship of PCB concentration with sample depth for in-stream sediments in Area 3. These figures demonstrate that the maximum sediment PCB concentrations are predominantly observed in the top 12 inches of sediments.

Figure 4-5. Relationship of PCB Concentration and Sample Depth – In-Stream Sediment



Note:
Data presented at the average depth of the sample interval. For example, the depth of a sample from the 12-24 inch depth horizon is reported as 18 inches deep.

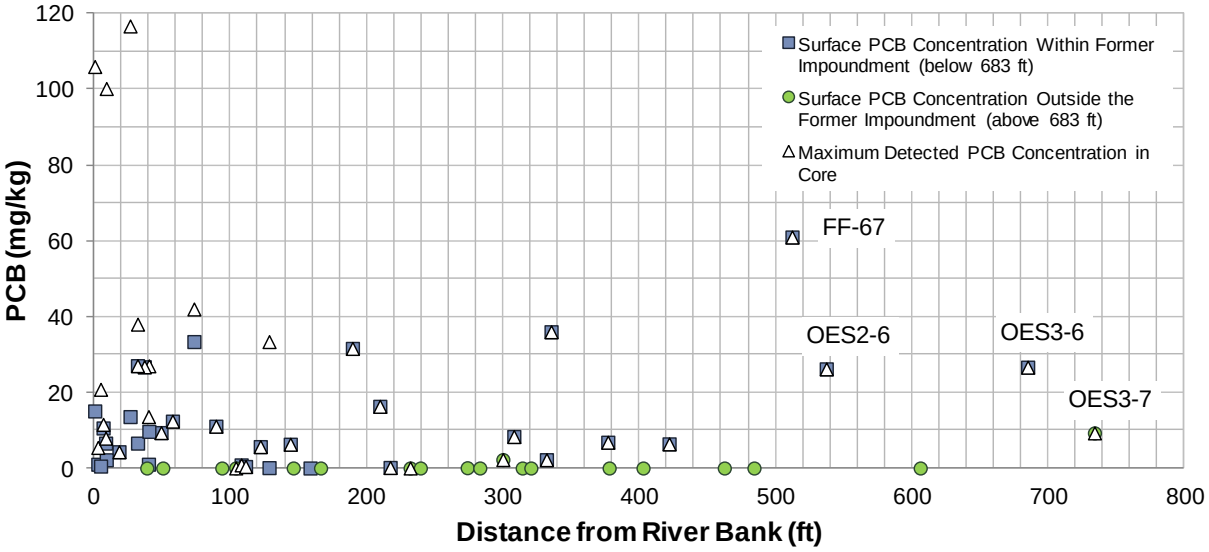
4.2.2 PCBs in Floodplain Soil

Based on the existing data, the arithmetic average surficial (typically top six inches) soil PCB concentration in the floodplain soils (including exposed sediments in the formerly impounded areas) in Area 3 is 8.3 mg/kg, with a median of 1.9 mg/kg. Of 53 core sample locations, 43% of the surficial soil samples contain PCB concentrations below 1 mg/kg and 26% contain PCB concentrations greater than 10 mg/kg.

Soil data collected to date show that the highest PCB concentrations are typically found closest to the river in the exposed sediment of the former impoundment where present-day ground surface elevations are lowest (see Figures 4-6 and 4-7, below). PCB concentrations generally decrease with distance from the current river channel and tend to be higher in the uppermost layer, generally decreasing with depth (with some exceptions). Exceptions may be present where former channels that lie some distance

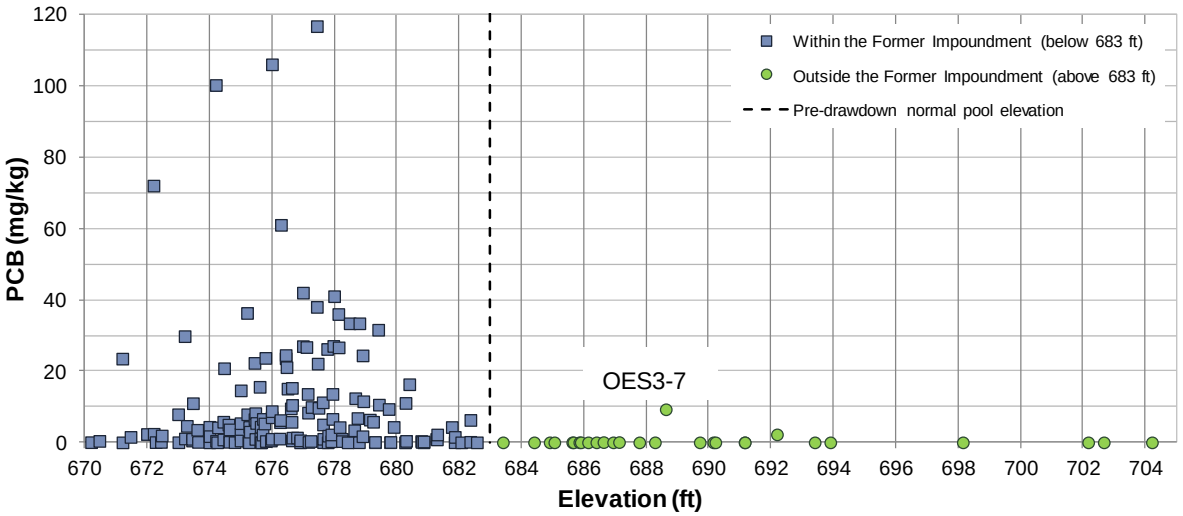
away from the current channel preferentially accumulated fine sediments during the period that the area was impounded.

Figure 4-6. Relationship of Former Impoundment Transect PCB Concentration and Distance from River Bank



Note:
Samples FF-67, OES2-6, OES3-6, and OES3-7 lie within or next to the previous channel running on the north side of the River, downstream of the former railroad bridge

Figure 4-7. Exposed Sediment and Soil PCB Levels in Relation to Elevation and Former Impoundment Pool Elevation



Note:
Sample OES3-7 lies next to the previous channel running on the north side of the River, immediately downstream of the former railroad bridge. The ground elevation at this sample location will be resurveyed and if the elevation is confirmed to be greater than 683, the location will be re-sampled.

PCB distribution in the floodplain soils of the formerly impounded area is predominantly a function of depositional processes during the period of impoundment, when the area was underwater. These depositional processes varied spatially as a result of impoundment morphology, resulting in a wide area of thicker PCB-containing material compared to the natural floodplains. These deposits, which contain a significant inventory of PCBs, are typically thickest in the center of the pre-impoundment river channel, likely due to the fact that these areas represented the deepest parts of the impoundment prior to the drawdown of the dams and as a result would likely have experienced the highest rate of sediment deposition. Furthermore, since these areas were impounded and accumulating sediment in the 1960s and early 1970s during the period of peak usage of PCBs, they tend to contain distinctly higher PCB concentrations than the natural floodplains.

4.3 PCB Levels in Biota

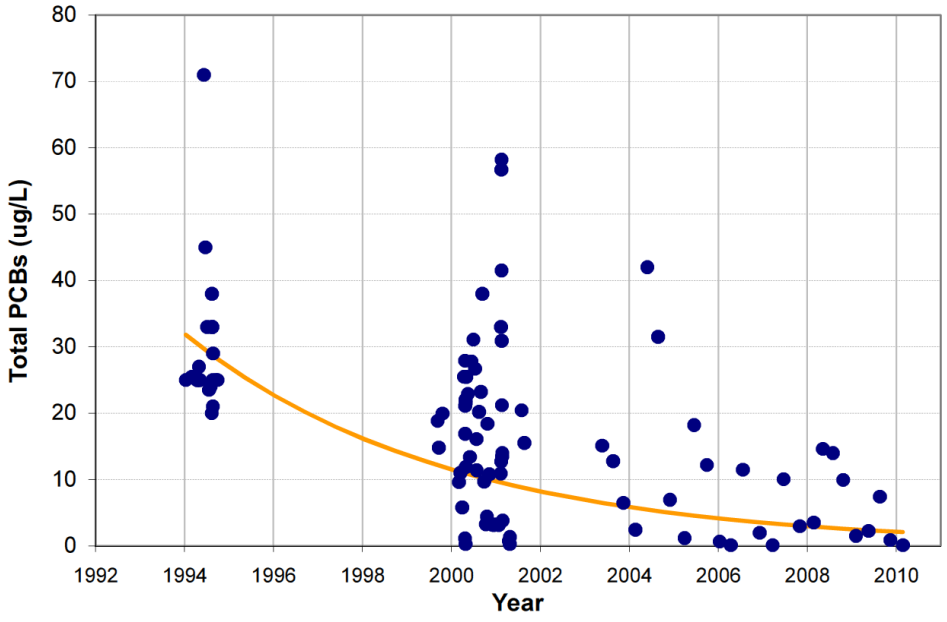
Fish tissue PCB samples have been collected intermittently in Area 3 since the 1980s, and long-term records are available for certain species, in particular smallmouth bass and carp. Table 4-1 summarizes the fish data collected from 1993 to present. PCB concentrations for the most recent samples collected in 2009 ranged from 0.11 mg/kg

to 7.3 mg/kg for carp fillets and 0.15 mg/kg to 0.8 mg/kg for smallmouth bass fillets, with averages of 2.9 mg/kg and 0.44 mg/kg, respectively (and median PCB concentrations of 2.7 mg/kg and 0.32 mg/kg, respectively).

4.4 PCB Levels in Water

Surface water sampling data are available in Area 3, predominantly from the Farmer Street Bridge located in the upper portion of Area 3, with limited samples also collected from a sampling point just upstream of the Otsego Dam. Since 1993, there has been a general downward trend in PCB levels, as indicated in Figure 4-8, below. Available PCB surface water data, including additional data collected by MDEQ at Farmer Street or other locations pertinent to Area 3 as part of their ongoing long-term monitoring program, will be presented in the Area 3 SRI Report. Additional MDEQ surface water data are available from a location immediately downstream of the Otsego Dam. These data will be considered and included, as applicable, in the Area 3 SRI Report. No further surface water sampling is proposed as part of this Area 3 SRI/FS Work Plan.

Figure 4-8. Surface Water PCB Concentrations in Samples Collected at the Farmer Street Bridge between 1993 and 2010



Note:
The orange line represents an exponential PCB trendline for the data

4.5 Bank Erosion and PCB Transport

Bank erosion processes in the exposed sediment of the former Otsego Impoundment contribute PCB loading to the Kalamazoo River. The drawdown of the former Otsego Impoundment increased the slope of the river, resulting in increased river velocities and erosional conditions as the river carved a new channel through the sediment bed. The lowering of the channel also exposed large areas of the previously submerged sediments, which later became vegetated. These exposed sediments comprise the current river bank and a portion of the floodplains. Former impoundment exposed sediment account for approximately 22,000 feet of bank in Area 3.

The rapid incision of the channel into the sediment bed resulted in steep, unstable banks comprised of PCB-containing former sediments that have continued to erode over time. Data collected from the erosion pins established in the impoundment (described in Section 3.4.1) are provided in Appendix D. Over two years of erosion pin monitoring from 2000 to 2002, erosion was observed at 60% of the erosion pin transect locations, at rates of up to 1.3 feet per year horizontally as measured at the top of bank. At some locations, minimal or no erosion was observed. Observations in the field indicated that bank loss was more of an event occurrence, where bank undercutting or sloughing of large chunks from freeze/thaw cycles would cause loss of relatively large pieces at a time, and less affected by slow, consistent erosion of bank soil. Bank profiles and erosion rates will be analyzed and presented in the Area 3 SRI Report once further survey data have been collected.

4.6 Exposure Pathways and Receptors

Humans and ecological receptors can be exposed to chemicals in the environment via various exposure pathways. As part of prior risk assessment activities at the Site (CDM 2003a and b), exposure pathways have been identified, and in many cases associated potential risks have been estimated. The findings of these prior risk assessments provide a basis for understanding which exposure pathways require quantitative assessment during the Area-specific SRI/FS process to identify whether reductions in exposure and potential risk are necessary. Similarly, the prior assessments indicate which pathways are not likely to be significant and hence will not require specific, directed exposure reduction. This section identifies and describes the exposure pathways for human and ecological receptors to be evaluated for Area 3.

4.6.1 Ecological CSM

The Generalized CSMs for both aquatic and terrestrial habitats were presented in the Generalized CSM (ARCADIS 2009b). Based on agreements reached during the Area 1 ecological risk assessment process, the aquatic portion of the Site-Wide BERA conducted by CDM (CDM 2003a) will not be revisited for Area 3. Therefore, this section focuses on the terrestrial CSM for Area 3. The preliminary terrestrial CSM for Area 3 is modified from the Generalized CSM (ARCADIS 2009b) to include the identification and evaluation of complete exposure pathways for insectivorous birds and vermivorous mammals. Factors considered in the development of the Area 3 terrestrial CSM include critical fate and transport routes, the potential for contaminant migration and bioavailability, and characterization of particular habitats. The preliminary terrestrial CSM is illustrated in Figure 4-9.

For the terrestrial habitats within Area 3, complete pathways were identified between:

- Floodplain soils/contaminated prey and omnivorous birds and mammals
- Floodplain soils/contaminated prey and insectivorous birds and mammals
- Floodplain soils/contaminated prey and vermivorous birds and mammals
- Floodplain soils/contaminated prey and carnivorous birds and mammals

Based on what is known about the dietary components of each of these receptor feeding guilds, the omnivorous species which consume a significant portion of vegetation in their diets are expected to be less exposed than insectivorous, vermivorous, or carnivorous species. Therefore, omnivores will not be quantitatively evaluated, and the evaluation of the other more highly exposed feeding guilds will be considered protective of omnivorous species. Likewise, the evaluation of the northern short-tailed shrew (i.e., a vermivorous mammal) will be considered adequately representative of insectivorous mammals. Receptor guilds that will be evaluated quantitatively include insectivorous birds, vermivorous birds and mammals, and carnivorous birds and mammals.

4.6.2 Human Health CSM

The Generalized CSM (ARCADIS 2009b) also included a discussion of potential pathways for human receptors. In that document, the potentially complete pathways

that were identified for possible quantitative evaluation were ingestion of biota and direct contact – via dermal contact or ingestion – of in-stream sediments and floodplain soils.

The potential risks associated with consumption of biota other than fish (e.g., turtles and waterfowl) were evaluated by CDM (2003b), but it is the potential exposure and risks associated with the consumption of fish that are expected to drive human health risks at the Site. Therefore, the focus of the human health risk assessment work for Area 3 will be to update the risks associated with fish consumption by anglers. These updated risk calculations will be developed using the same equations, exposure parameters, and toxicity criteria applied in CDM's BHHRA (CDM 2003b), but the assessment will be updated to incorporate all fish tissue data available to estimate the PCB concentrations to which individuals might be exposed in Area 3.

Although a vegetable garden was observed in the floodplains of the former impoundment during 2000 (CDM 2003b) and soils and biota from the gardens were sampled , an evaluation of ingestion of homegrown produce was not included in the quantitative risk assessment by CDM (2003b) as it was not considered sufficiently important to analyze. This pathway is not proposed for evaluation in the Area 3 assessment. If current use of the impoundment is documented to include continued vegetable gardening, the potential need to evaluate this pathway will be discussed with USEPA.

Several other potential exposure pathways were described by CDM in the BHHRA (2003b) or in the Michigan Department of Community Health (MDCH) Health Consultation (MDCH 2002; prepared in cooperative agreement with the Agency for Toxic Substances and Disease Registry [ATSDR]) but were not considered to be important means of exposure to PCBs. As a result, direct contact with river sediment, exposure to surface water, and exposure to air will not be considered in an Area 3 assessment. CDM's (2003b) CSM for potential human health exposure pathways is presented in Figure 4-10.

5. Identification of Data Needs and Sampling Activities

The SOW requires that Area-specific DQOs be detailed in each Area-specific work plan. USEPA guidance (2006) describes principles of the DQO process and presents a seven-step planning process intended to guide development of specific objectives such that the data collected are of the appropriate type and quality for their intended use.

5.1 Data Quality Objectives Process

The seven steps and their application are described below.

Step 1: State the Problem

PCBs are present in Kalamazoo River fish tissue at levels deemed unacceptable for both ecological and human receptors. PCBs are also present in sediments and soils at potentially unacceptable levels.

The distribution of PCBs in the reach between the Otsego City Dam and the Otsego Dam has been documented as part of previous investigations, but supplemental data are needed to provide an up-to-date and improved characterization of PCBs in Area 3 of the Site to reduce uncertainty in assessing risks and evaluating potential remedial alternatives in the FS.

Step 2: Identify the Goals of the Study

The goals of the investigation described in this Area 3 SRI/FS Work Plan are to provide up-to-date supplemental information to complete a SRI and a FS, and support development of a ROD. Data collected as part of this Area 3 SRI/FS Work Plan will be used to:

- Describe the nature and extent of PCBs in Area 3.
- Estimate the PCB mass inventory in Area 3.
- Estimate PCB loading to the Kalamazoo River from bank erosion.
- Develop current PCB exposure concentrations in soils and sediments in Area 3 for human health and ecological risk assessments.
- Evaluate the presence of non-PCB constituents in Area 3 and gauge their potential significance

- Identify and evaluate appropriate remedial alternatives for the Area 3 FS.

Step 3: Identify Information Inputs

Information inputs to the SRI/FS will include the existing data and the supplemental data summarized below.

- Surface soil and surface sediment PCB concentrations will be used in the evaluation of potential risks. This will include sediment type, location and extent of any significant fine sediment deposits, and PCB and TOC data representative of current conditions in both soil and sediment.

- Surface and subsurface soil and sediment PCB data will be used for PCB mass and PCB-containing soil and sediment volume inventory estimates.

- Historical and recent aerial photos and topographic maps will be used to describe locations and extent of pertinent geomorphologic features, and representative existing and supplemental data will be used to characterize PCB concentrations in those features.

- Existing and supplemental soil and sediment thickness data and PCB data will be used along with existing topography data to refine maps of sediment and soil thicknesses, pertinent geomorphological features, and PCB distributions across Area 3 and in the key geomorphic features, as well as to estimate potential PCB loading from the banks to the river, and to develop and evaluate potential removal and/or restoration scenarios/alternatives.

- Existing and supplemental floodplain topography, bank and transect survey data, PCB data, existing hydraulic information, and hydraulic information from updated hydraulic modeling will be used in conjunction with bank erosion pin survey data to develop estimates of bank soil and PCB erosion rates.

- Existing fish tissue data from recent sampling in 2009 (or any available more recent data from MDEQ) together with prior data will be used to update human health risk calculations.

- Existing water column data from prior sampling by KRSG and the State of Michigan will be used to describe water column PCB concentrations and transport.

Step 4: Define the Boundaries of the Sampling

The geographic boundaries of Area 3 include the Kalamazoo River and the present-day floodplain between the location of the Otsego City Dam and the Otsego Dam, and the Pine Creek Pond, as illustrated on Figure 2-1. The specific Study Area boundary of the investigation area (shown on Figure 2-1) was derived from the outer extent of the FEMA 100-year floodplain boundary (as presented in the Flood Insurance Rate Map [FEMA], No Flood Insurance Study or probable maximum flood elevation is available for the area), 683 feet NGVD 29 contour, and visually identified impounded areas from historical photographs to include all regions that may have been affected by historical flooding and inundation. The Study Area boundary may be reassessed in certain locations based on the results of field reconnaissance (i.e., prior to sampling) and based on the simulated water surface elevations from the proposed hydrodynamic modeling (see Section 5.5).

Step 5: Develop the Analytic Approach

The analytic approach to complete the work described in this Area 3 SRI/FS Work Plan will incorporate both statistical hypotheses testing and estimation or other analytic approaches. The analytic approach includes, but is not limited to:

- Statistical and geostatistical evaluation, as appropriate, of soil/sediment PCB concentrations within topographic elevation and/or identified geomorphologic strata to assess soil/sediment PCB concentration distributions within and among these strata.

- Calculation of updated soil and sediment PCB mass and PCB-containing soil and sediment volume inventories.

- Estimation of annual bank erosion PCB load.

- Soil and sediment data will be used to develop Exposure Point Concentrations (EPCs) for comparison to Risk-Based Concentrations (RBCs) or other pertinent values from existing risk assessments.

- Spatial mapping of surface and core maximum sediment and floodplain soil PCB concentrations.

Step 6: Specify Performance or Acceptance Criteria

Based on the potential uses of the data in the decision-making process, performance criteria and acceptance criteria will be equivalent to those associated with data collected as part of the original RI (BBL 2000a), the 2000 Supplemental Investigations (BBL 2000b), and USEPA-approved work plans associated with SRI activities. Data quality assurance/quality control will be managed as described in the Multi-Area FSP (ARCADIS BBL 2007a) and its associated addenda and Multi-Area QAPP (ARCADIS 2010a). Performance or acceptance criteria for data applications, such as statistical comparisons or trend analysis, will depend on the data results and variance of the data.

Step 7: Design Optimization

Implementation of the sampling activities will result in data that can be used to meet the objectives of the SRI/FS. Data gaps are identified and the rationale for specific phased field investigations is provided in Section 5.2 while specific sampling and analysis activities will be described in further detail in sampling plans to be developed for each phase for USEPA approval. The iterative and adaptive approach to data collection is provided for in USEPA DQO guidance, and is reflected in the phased study approach outlined in this Area 3 SRI/FS Work Plan.

5.2 Identification of Supplemental Data Needs and Data Quality Objectives

Task 1.3.2 of the SOW requires an assessment of data gaps. Supplementing the available data to document current conditions and refine the characterization of the nature and extent of PCBs in Area 3 will reduce uncertainty associated with assessment of risks and evaluation of alternatives. Any data necessary beyond adequate characterization for SRI/FS purposes is anticipated to be collected as part of pre-design investigations for the selected remedy. The focus of the data collection efforts described below will be on PCBs. With regard to non-PCB constituent data, SRI-related sampling work is currently ongoing in Area 2 and is complete in Area 1 of the Site. The purpose of the Area 2 non-PCB sampling and analysis is to confirm the conclusion of the Area 1 non-PCB data screening (ARCADIS 2011), which is that the appropriate focus of work is on PCBs as the key driver of potential risks at the Site. Transport and deposition of non-PCB constituents with sediments in Area 3 is likely to be similar to Area 2 unless there are additional point sources within Area 3 that would change this pattern. Non-PCB constituent data collected in Area 3 as part of the SRI work, as appropriate based on the outcome of sampling efforts in Area 2, will be used to evaluate this hypothesis. The proposed non-PCB sampling, along with a review of

point source locations within Area 3, will be included in the Area 3-specific sampling plan. The sampling approach and constituents to be included will be established in collaboration with USEPA, and with USEPA approval, based on a review of non-PCB data developed during the Area 1 and 2 SRI activities, and a review of constituents in paper residuals in the former landfill operable units.-

This Area 3 SRI/FS Work Plan proposes collection of the following data:

- Reconnaissance
  - Locations, size, and general extent of topographic low areas and/or historical depositional areas will be identified from topographic maps and historical aerial photos, adjusted as necessary based on field observations.
- Survey
  - River cross-section elevation and sediment probing data throughout Area 3 and in the Pine Creek Pond.
  - Staff gage installation and water level recording.
- Sediment
  - Surface and subsurface sediment PCB data from Area 3 and in the Pine Creek Pond.
- River Bank and Floodplain Soil
  - Floodplain soil PCB data representative of elevation strata and/or historical depositional strata within the formerly impounded area.
  - Bank soil PCB data representative of bank types along the river, particularly in the former impoundment.
  - Floodplain soil upstream of impoundment where residential/recreational use extends to the water's edge.

- Floodplain soil PCB data in areas potentially affected by flooding throughout Area 3.

- Biotic Tissue Data

  - Most recent fish tissue PCB data, including MDEQ data, as applicable, will be used to update angler risk calculations

5.3 Sampling Activities to Meet DQOs

Sampling activities proposed for Area 3 will be conducted in one or more investigation phases, as described in the following sections. An initial sampling plan will be developed and submitted to USEPA for review and approval, and subsequent adaptive, iterative phases will be described in additional plans. As described in Section 8, the initial reconnaissance work will be conducted as described below, then a soil and sediment sampling plan – developed based on the results of the reconnaissance – will be submitted to USEPA by July 2012.

5.3.1 Reconnaissance

5.3.1.1 Preliminary Identification of Sampling Strata

Floodplain Soils

The soil PCB characterization approach for Area 3 will include a geomorphic-based component, so that identified floodplain soil strata are specifically represented in PCB data evaluation to identify differences and distinctions between specific strata. Sampling strata have been preliminarily identified through review of historical aerial photographs, topography, and existing PCB data. The strata and delineating boundaries will be evaluated, and refined as appropriate, through field activities and additional PCB data collected as part of this Area 3 SRI/FS Work Plan.

Soil strata of interest were identified using historical aerial photographs (Figures 2-2a through i), along with a current aerial photograph, a high-resolution digital elevation map generated from the March 2010 flyover (see Appendix E), and previously-collected PCB data in Area 3 (see Figures 3-1, 3-2, and 3-3). These data were reviewed to identify approximate boundaries and general characteristics of topographically similar areas and pertinent geomorphological features, including potential historical depositional areas in the impoundment. Factors considered in this analysis included the

frequency and duration of inundation of areas of the impoundment, the nature of inundation (i.e., flooding, standing water, flowing water, and water storage), and the historical movement and infilling of channels. Feature types (i.e., soil strata) consisting of previous channels and terrace areas were identified from aerial photographs as follows:

- Previous Channel – Areas PC-01 through PC-10 – Most of these areas appear to have carried water through and were permanently inundated in the aerial photographs from 1938 through 1967.

- Terrace – Areas T1 through T7 shown to be mostly submerged in previous aerial photographs from 1938 through 1955 and partially submerged in 1960 and 1967. These areas are also below the previous dam impoundment elevation of 683 feet.

As illustrated in Figures 3-1 through 3-3, previous sampling in Area 3 has demonstrated that PCB concentrations are lower (with the majority being non-detect) in samples collected above an elevation of 683 feet NGVD 29. Figures 5-1a and 5-1b depict the approximate boundaries of strata preliminarily identified from the historical aerial photograph review.

Additional data requirements prior to incorporation of these strata in sampling plan design include:

- information on general characteristics of soils in each area

- relative consistency of topography, vegetation, and soil type within each area

- confirmation that the preliminary strata boundaries are established in the correct locations

- information on the presence or absence of certain materials (suspected to contain PCBs), which may warrant additional sampling

Figure 5-2 provides box plots and cumulative frequency distributions for the preliminarily-identified geomorphic features (strata). These figures indicate that the PCB concentrations in previous channel areas are generally higher on average than concentrations measured in other strata. Additionally, previous channel and terrace soils have lower solids and higher organic carbon content, indicative of deposition of

finer gained material, in comparison to the main channel sediments and non-designated soil areas.

Sediments

Locations of potential fine-grained sediment deposits within pertinent geomorphological features in the river and floodplain, including potential historical depositional areas, have been identified through review of the high resolution aerial photos of Area 3 obtained from the flyover in March 2010 (Appendix E) and historical aerial photos (an example set of which is shown in Figures 2-2a through i). These will be confirmed in the field and sampled during the transect sampling and survey work, following reconnaissance.

5.3.1.2 Field Reconnaissance of Floodplain Soils

Floodplain reconnaissance is expected to consist of the following activities:

- A team of ARCADIS personnel and Agency representatives will visit Area 3 (Figure 2-1) to visually describe soil characteristics (using shallow soil borings) and document visible water marks, topographic changes, and vegetation within and at boundaries of the preliminary floodplain strata (Figures 5-1a and 5-1b).

- Reconnaissance will be carried out using a transect-based approach, augmented with additional detailed observations at other locations as deemed necessary in the field (e.g., along identifiable strata boundaries).

- The areas and boundaries of the preliminarily-identified previous channel and terrace features will be reconnoitered in greater detail to assess if there are any obvious boundary features visible in the field.

- Table 5-1 includes a guide to the key soil characteristics the field teams will observe and document. Field indicators will be noted predominantly by visual assessment. Soil characteristics will be inspected at select locations, using hand augers advanced to depths of approximately 2 to 3 feet. Additional equipment will be utilized if collection of core samples from deeper intervals is needed. Soil characteristics will be identified and logged by an experienced field geologist. Photos will be taken of all soil samples. A hand-held global positioning system (GPS) unit, or comparable equipment, will be used to record coordinates of observations as appropriate.

Locations of proposed transects will be coordinated with USEPA and MDEQ prior to reconnaissance activities.

5.3.1.3 Sediment Probing

Reconnaissance of sediments in Area 3 is expected to consist of the following activities:

- The main channel of the river and the ponded area of Pine Creek (i.e., the surface water area within the Study Area boundary) will be reconnoitered by boat, and substantial deposits/accumulations (i.e., deposits that are readily identifiable from a boat and have dimensions exceeding approximately 0.25 acres) of fine-grained sediments will be noted. These sediment deposits will be identified through visual observation of texture (fine vs. coarse) at the time of field reconnaissance as well as localized geomorphological characteristics (channel geometry, aggrading bars, terraces, and bank slopes). Probing with Lexan® tubes at locations selected by the field crews based on these observations will retrieve samples to determine whether fine sediments are present.

- Locations where fine-grained sediment deposits are present will be recorded based on GPS coordinate readouts.

- Sediment characteristics will be inspected at multiple locations within identified deposits using hand-driven Lexan® tubes. Cores will be opened and inspected in the field and materials described visually by personnel experienced in core sampling and characterization at the Site. Following inspection, cores will be disposed in the field. Locations for probing with Lexan® will be at the field team leader's discretion. Table 5-1 includes a guide to the key sediment characteristics the field teams will observe and document. Soft sediment thickness may be assessed using steel rods.

- Changes in depth and flow velocity in areas with accumulation of fine-grained materials or identified soft sediments will also be noted.

5.3.2 Main Channel and Bank Profile Survey

Cross-sectional data of the river channel (including the Pine Creek Pond) and the bank profiles will be collected throughout Area 3 during soil and sediment sampling activities. Sediment data collection will include sediment transect surveys and sediment probing and coring to characterize the river cross-section and sediment characteristics, while

bank profile surveys will be performed to characterize the shape and conditions of the bank, as well as to re-visit previously established profile location to estimate bank losses since 2000. Cross-sectional data and bank profiling activities will be further detailed in the Area 3-specific sampling plan.

5.3.3 Bank and Floodplain Soil Sampling

Following completion of reconnaissance work at Area 3, a floodplain soil sampling plan for the geomorphic strata confirmed during field reconnaissance activities will be prepared for USEPA approval. The plan will be designed to provide representative data when existing and supplemental samples are combined and provide higher sample density within strata identified with a greater likelihood of having accumulated PCBs. For areas where there are PCB data from prior efforts, those existing data will be used to characterize final strata and guide future sampling. Based on the existing information, proposed sample locations will be allocated with consideration to the relative size and occurrence of a given strata and the likelihood of a strata to contain fine-grained sediment (or PCBs). The sampling plan will also include proposed sample locations adjacent to the main channel upstream of the formerly impounded area to supplement existing data, which are presently limited in spatial coverage.

The floodplain soil sampling plan will also include a top-of-bank soil sampling component. Sample locations will be selected based on consideration of bank types and geomorphology of Area 3. It is anticipated that most sampling locations will coincide with bank profile locations established during the survey described in Section 5.3.2. Soil samples will be collected from the top of the river bank at locations outlined in the sampling plan to characterize the nature and extent of PCBs in bank soils and estimate PCB loading to the river from bank erosion. Collection techniques will be described further in the Area-specific Field Sampling Plan.

In addition to the data considerations described above, the floodplain soil sampling plan will also include sampling to address specific risk assessment data needs, as described in Section 6. If additional data needs are identified for risk assessment, any proposed additional data collection will be included in a floodplain soil sampling plan developed for USEPA review and approval.

5.3.4 Sediment Sampling

A sampling plan for fine-grained sediment deposits will be prepared for USEPA approval based on the final target areas developed through the survey and

reconnaissance activities described above. In conjunction with biased sampling of fine sediments, additional random sampling will also be included to provide supplemental data from coarse strata in under sampled areas.

5.4 Incorporation of MDEQ Long-Term Monitoring Data

It is anticipated that all water column and fish data collected by MDEQ as part of its long-term monitoring plan will be incorporated into the Area 3 SRI. If sufficient data are not available, a field sampling plan will be developed and implemented to collect necessary supplemental data.

5.5 Hydraulic Modeling

A hydraulic model will be prepared for Area 3 for use in the SRI and FS. The model will be prepared by enhancing one of the existing models described in Section 3.4.2. after incorporating the more detailed topographic data obtained in March 2010 and updated transect bathymetry data (to be collected as described above). Alternatively, an equivalent two-dimensional model will be developed similar to that prepared for the former Plainwell Impoundment (ARCADIS BBL 2007c).

6. Risk Assessment Approach

6.1 Background

Since CDM developed its risk assessments (CDM 2003a, b), USEPA has issued additional risk assessment guidance, relevant research has been presented in the scientific literature, additional Site-specific data have been collected, and further sampling is planned in Area 3. The Area 3 baseline risk assessments will incorporate current Agency guidance, current science, and new data, as appropriate.

As described in the SRI/FS AOC and the SOW, the development of the Area-specific risk assessments will be a collaborative process between Georgia-Pacific and USEPA, with the MDEQ having the opportunity to participate.

As described in the RA Framework (ARCADIS 2008), and consistent with the approach employed in the Area 1 TBERA, the existing USEPA-approved risk assessments performed by Camp Dresser & McKee (CDM) (CDM 2003a and 2003b) will serve as a point of departure for the Area 3 risk assessment. Many of the specific inputs for the risk assessment will be the same as those used in the Area 1 risk assessments as described below.

6.2 Incorporation of Prior Risk Assessments

Consistent with agreements reached with USEPA for Area 1, the Area 3 TBERA will be conducted only for the terrestrial floodplain areas of the former impoundment. The conclusions for the in-stream aquatic environment provided in the CDM BERA (CDM 2003a) will be carried forward for the in-stream portions of Area 3. For the terrestrial floodplain area, the preliminary ecological CSM for Area 3 described in Section 4.6.1 and shown on Figure 4-9 is identical to the CSM developed for Area 1. Thus, the same assessment and measurement endpoints and representative receptors identified for Area 1 will be evaluated in Area 3. Because the key elements of the problem formulation, exposure and effects assessment for Area 1 are not expected to change for Area 3, the scope of the Area 3 TBERA will primarily include the comparison of RBCs developed and approved as part of SRI/FS work for Area 1 to floodplain soil EPCs developed for Area 3.

To estimate floodplain soil EPCs for each of the representative receptors, it is anticipated that an approach very similar to the approach developed for Area 1 will be used. Based on this assumption, spatial data needs specific to the TBERA will be

considered when the floodplain soil sampling plan is developed, as described in Section 5.3.3. Based on the approach developed for Area 1, it is expected that supplemental floodplain soil sampling data will provide the necessary additional data for conducting the TBERA for Area 3.

Consistent with the approach taken for Area 1, new HHRA work carried out as part of the Area 3 SRI/FS is anticipated to consist primarily of the preparation of updated risk estimates for fish consumers. These updated risk estimates will be based on more recent measurements of PCB concentrations in fish tissue than the 1993 data upon which CDM relied in the 2003 assessment (CDM 2003b). Given the limited scope of these activities, a separate baseline HHRA report will not be prepared for Area 3; instead, the updated risk estimates will be appended to and discussed within the Area 3 SRI Report.

An adjacent property owner on the north side of the impoundment had once used a portion of the State land within the impoundment for a vegetable garden. This home owner was notified by the State that gardening was not permitted. No further information concerning gardening activity in the impoundment has been reported. As part of SRI activities, a land use assessment for Area 3 will be prepared, and will incorporate a site walk to observe and record land use activity, in addition to inspection of high resolution air photos. The HHRA completed by CDM (2003b) noted the presence of the garden but did not include a gardener scenario. If continued vegetable gardening within the former impoundment is documented, the need to prepare a risk assessment for humans consuming vegetables grown in the floodplains will be discussed with USEPA, and if required, this will be incorporated in the Area 3 HHRA in a manner consistent with applicable USEPA guidance.

7. Feasibility Study

As detailed in the SOW, a range of remedial alternatives specific to Area 3 will be evaluated in the FS. An Alternatives Screening Technical Memorandum (ASTM) will be prepared that summarizes the development and screening of an appropriate range of viable alternatives to be considered in the detailed analysis presented in the FS. The ASTM will include:

- Development of Area 3 remedial action objectives
- Identification of areas or volumes of media to be remediated
- Identification and screening of remedial technologies
- Assembly of alternatives

The schedule for completion of the ASTM is identified in the SOW to be 60 days following submittal of the Draft Area 3 SRI Report. It is anticipated, however, that an alternative schedule for submittal of the ASTM may be developed in consultation with USEPA so that submittal of the ASTM follows USEPA's initial review and comment on the Area 3 SRI Report.

Following Agency comment on the ASTM, an FS will be conducted, which will present a detailed analysis of remedial alternatives to provide USEPA with the information needed to select an Area 3-specific remedy. The FS report will include the detailed individual analysis of each remedial option against seven of the nine evaluation criteria set forth in 40 CFR 300.430(e)(9)(iii) and a comparative analysis of all options using the same criteria as a basis for comparison. The nine evaluation criteria include:

- Overall protection of human health and the environment and how the alternative meets each of the remedial action objectives
- Compliance with applicable or relevant and appropriate requirements
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment

- Short-term effectiveness
- Implementability
- Cost
- State (or support agency) acceptance (this criterion is typically evaluated by USEPA)
- Community acceptance (this criterion is typically evaluated by USEPA)

It is anticipated that the Area 3 FS documents will incorporate the approaches developed for the Area 1 and Area 2 ASTMs and FS reports, to the extent appropriate.

8. Reporting and Schedule

8.1 Progress Reports

As described in the AOC and SOW, monthly written progress reports will be submitted to USEPA and MDEQ to describe the status of the project. The Area 3 activities pursuant to this Area 3 SRI/FS Work Plan will be documented as part of the monthly progress reports that are regularly submitted for Area 1 and Area 2 work.

In addition to the monthly progress reports, a Semi-Annual Progress Report will also be submitted and will describe work in Areas 1, 2, and 3.

Both the monthly and semi-annual progress reports will be submitted until the termination of the AOC, unless otherwise directed by USEPA.

8.2 Schedule

The SRI/FS schedule will follow the requirements of the AOC unless otherwise approved by USEPA.

It is anticipated that field activities will be completed in phases, as described in Section 5. The timing of field activities will be contingent on USEPA approval of sampling plans, completion of necessary access agreements, seasonal weather conditions, and completion of subsequent phases where specific sampling approaches are to be guided by initial data collection efforts.

As described in the AOC, USEPA and MDEQ will be notified of planned field activities at least 15 days prior to conducting significant field events, but to the extent possible, specific schedules will be included in each sampling plan submitted to USEPA for review and approval. Field activities will be scheduled to avoid/minimize late fall and winter work to reduce safety risks related to cold weather and the risks associated with the significant hunting activity that occurs in and along the floodplains of the Kalamazoo River during the late fall and early winter. If deviations from the submitted/approved schedules are deemed prudent due to safety issues or other concerns, Georgia-Pacific and ARCADIS will submit an updated schedule to USEPA for review and approval along with the rationale for the request.

The draft Area 3 SRI Report will be submitted for USEPA and MDEQ for review no later than November 30, 2013.

Table 8-1 outlines the submittals and key milestones that are currently anticipated as part of the Area 3 SRI/FS activities.

Table 8-1. Summary of Key Area 3 Submittals and Milestones

Submittal/Milestone	Estimated Schedule	Estimated Date
Draft Area 3 SRI/FS Work Plan (this document)	90 days from Project Start Date (September 1)	November 29, 2011
Revised Draft Area 3 SRI/FS Work Plan	60 days from direction to modify	February 2012
Area 3 SRI/FS Work Plan Approval by USEPA	4 weeks after Area 3 SRI/FS Work Plan submittal	March 2012
Identification of Reconnaissance Locations	60 days after Area 3 SRI/FS Work Plan approval	April 2012
Access Agreements Completed	Coincide with start of reconnaissance	May 2012
Field Reconnaissance	60 days to mobilize, complete fieldwork, and document	May – June 2012
Draft Area 3 Survey and Soil and Sediment Sampling Plan based on Reconnaissance for USEPA review	60 days after reconnaissance is complete	July 2012
Meeting/Call to review Draft Phase 2 Sampling Plan	30 days after Draft Field Sampling Plan submittal	August 2012
Final Phase 2 Sampling Plan	30 days after meeting and Agency comments on Draft Field Sampling Plan	September 2012
USEPA approval of Phase 2 Sampling Plan	2 weeks after submittal of Field Sampling Plan	September 2012
Soil and Sediment Survey and Sampling	30 days after USEPA approval of Field Sampling Plan	October 2012
Laboratory Analysis and Validation	60 days from completion of sampling	December 2012
Sampling Results/Data Summary and Maps for USEPA Review	60 days from completion of sample validation	February 2013

Submittal/Milestone	Estimated Schedule	Estimated Date
Meeting to Review Data Summary and Determine Adequacy for Area 3 Risk Assessment and SRI	30 days from Agency receipt of Sampling Results/Data Summary	March 2013
Contingent schedule for additional field work and/or SRI and risk assessment report planning meetings	60 days	April/May 2013
Preparation and Submittal of Draft Area 3 TBERA and SRI Report for Agency Review	Within 6 months following receipt of all sample data	November 30 2013*
Preparation and Submittal of Area 3 ASTM	60 days from receipt of Agency comments on SRI Report– or on alternative schedule approved by USEPA	January 2014
Receipt of Agency comments on Area 3 ASTM (assumed)	60 days from Submittal of Area 3 ASTM	March 2014
Submittal of Draft FS Report for Agency Review	90 days after receipt of Agency comments on Area 3 Alternatives Screening Technical Memorandum	June 2014

* If the timing of agency review and approval schedules throughout 2011, 2012, and 2013 result in an overall schedule that prevents a reasonable time period for preparation of the Draft SRI Report, with USEPA approval, the project team will collaborate to revise the November 30, 2013 due date .

In summary, the following planning materials will be provided to USEPA as part of the development of the Area 3 SRI Report:

- Field Sampling Plan for sediment, river bank, and floodplain soils
- Sampling results summary and maps on an interim basis before submittal of the Area 3 SRI Report
- Other sampling plans for sampling subsequent to implementation of the field sampling plan, as necessary
- Draft Area 3 SRI Report

9. References

ARCADIS. 2008. Risk Assessment Framework for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. June 2008.

ARCADIS. 2009a. Quality Management Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. May 2009.

ARCADIS. 2009b. Generalized Conceptual Site Model for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Generalized CSM). May 2009.

ARCADIS. 2010a. Multi-Area Quality Assurance Project Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Multi-Area QAPP). March 2010.

ARCADIS 2010b. Area 2/Otsego City Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan. December 2010.

ARCADIS. 2010c. Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. Multi-Area Feasibility Study Technical Memorandum: Evaluation of Candidate Technologies and Testing Needs. March 2010.

ARCADIS. 2010d. Area 1 Work Plan Supplement: Baseline Ecological Risk Assessment Work Plan. July 2010.

ARCADIS. 2011. Terrestrial Baseline Ecological Risk Assessment for Area 1. October 3, 2011.

ARCADIS BBL. 2007a. Multi-Area Field Sampling Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Multi-Area FSP). April 2007.

ARCADIS BBL. 2007b. Multi-Area Health and Safety Plan for the Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site (Multi-Area HSP). May 2007.

ARCADIS BBL. 2007c. Former Plainwell Impoundment Time-Critical Removal Action Design Report. February 2007.

Armstrong and Pahl. 1985. River and Lake. Allegan County Michigan. A Sesquicentennial History.

Bailey, M. 2000. Personal Communication with BBL. Michigan Department of Natural Resources, Wildlife Division, Plainwell Service Unit.

BBL. 2000a. Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site. Remedial Investigation Report – Phase 1. October 2000.

BBL. 2000b. Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site. Supplement to the Kalamazoo River RI/FS – Phase 1. October 2000.

CDM. 1999. Evaluation Report of Otsego Dam, Kalamazoo Michigan. Prepared for Michigan Department of Environmental Quality, Lansing, Michigan. January 1999 (Revised April 13, 1999).

CDM. 2002. Kalamazoo River and Portage Creek Wetland Delineation Study. Prepared on behalf of the MDEQ. January 2002.

CDM. 2003a. Final (Revised) Baseline Ecological Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. Prepared on behalf of the MDEQ Remediation and Redevelopment Division. April 2003.

CDM. 2003b. Final (Revised) Baseline Human Health Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site. Prepared on behalf of the MDEQ Remediation and Redevelopment Division. May 2003.

CDM. 2009. Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site Summary of Baseline PCB Concentrations in Surface Water and Fish Tissue; Evaluation of Pre- and Post-TCRA Data from the Bryant Mill Pond; and Site-Wide Trends in Fish Tissue PCB Concentrations. May 2009.

CDM. 2010. Dam Safety Inspection Report, Otsego Dam, Kalamazoo River, Allegan County.

Dalrymple, D. 1983. Memories of Pine Creek.

Limnotech. 2000. Modeling Analysis of PCB and Sediment Transport In Support of the Kalamazoo River Remedial Investigation/Feasibility Study. Appendix S-8 to the

Allied Paper Inc./Portage Creek/Kalamazoo River Superfund Site RI/FS Supplemental to the Kalamazoo River RI/FS – Phase 1. October 2000.

MDCH. 2002. Health Consultation: Allied Paper/Portage Creek/Kalamazoo River, Kalamazoo, Kalamazoo County, Michigan. May 2, 2002. Prepared by MDCH under a cooperative agreement with ATSDR. Available online at: http://www.atsdr.cdc.gov/hac/pha/pha.asp?docid=357&pg=0

Rachol, C.M., Fitzpatrick, F.A., and Rossi, T. 2005. Historical and Simulated Changes in Channel Characteristics of the Kalamazoo River, Plainwell to Otsego, Michigan: U.S. Geological Survey Scientific Investigations Report 2005-5044.

Rheaume, S.J., Rachol, C.M., Hubbell, D.L., and Simard, A. 2002. Sediment Characteristics and Configuration within Three Dam Impoundments on the Kalamazoo River, Michigan, 2000: U.S. Geological Survey Water-Resources Investigations Report 02-4098.

Rininger, R. 2000. Personal Communication with BBL. Allegan County drain commission, Chief Deputy. Pine Creek impoundment dam operator.

Rumsey. 2010. D. David Rumsey Map Collection, Cartography Associates. http://www.davidrumsey.com/ Retrieved on August 6, 2010.

SME. 2008. Dam Safety Inspection Report, Otsego Dam, Kalamazoo River, Allegan County. May 5, 2008.

Syed, A.U., Bennett, J.P., Rachol, C.M. 2004. A Pre-Dam Removal Assessment of Sediment Transport for Four Dams on the Kalamazoo River between Plainwell and Allegan, Michigan: U.S. Geological Survey Scientific Investigations Report 2004-5178.

USACE. 2011. National Inventory of Dams by United States Army Corps of Engineers, http://nid.usace.army.mil, Retrieved on November 16, 2011.

USEPA. 2006. Data Quality Assessment: A Reviewers Guide. EPA/240/B-002. February 2006.

USEPA. 2009. Letter from James Saric Regarding Request for Data Usability Determination. July 9, 2009.

Wells, R., Langendoen, E.J., Simon, A. 2007. Modeling Pre- and Post-Dam Removal Sediment Dynamics: The Kalamazoo River, Michigan: Journal of the American Water Resources Association Volume 43, Number 3. June 2007.

ARCADIS

Tables

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Table 3-2 -- KRSG Sample Investigation Summary

Sampling Event	Approximate Sample Dates	Analysis Year	Data Source	Media	Analyses (Total Number of Samples)	Data Usability Category
Biota Sampling						
1993/1994 Aquatic Biota Investigation	Oct 1993	1993	KRSG	Fish	Dioxin/Furans (2), Lipids (55), Mercury (33), PCB Aroclors (33), Pesticides (33)	1
2009 Biota Sampling	Oct 2009	2009	KRSG	Fish	Lipids (22), PCB Aroclors (22)	4
Soil Sampling						
1993 Floodplain Investigation	Jul 1993	1993	KRSG	Floodplain Soil	Inorganics (2), PCB Aroclors (19), Percent Solids (19), Pesticides (2), Semivolatiles (2), Total Organic Carbon (9), Volatiles (2)	1
1993 Terrestrial Biota Investigation	Sep 1993 - Oct 1993	1993	KRSG	Floodplain Soil	PCB Aroclors (3), Percent Solids (3)	1
1993/1994 Former Impoundment Sediment Investigation	Jan 1994 - Feb 1994	1994	KRSG	Floodplain Soil	Inorganics (2), PCB Aroclors (165), Percent Solids (165), Pesticides (2), Semivolatiles (2), Total Organic Carbon (101), Volatiles (2)	1
2000 Focused Sediment Sampling	May 2000	2000	KRSG	Floodplain Soil	Grain Size (12), PCB Aroclors (15), Percent Solids (15), Total Organic Carbon (15)	2
Sediment Sampling						
1993/1994 Sediment Investigation	Sep 1993 - Oct 1993	1997	KRSG	Sediment	Grain Size (38), Inorganics (6), PCB Aroclors (146), Percent Solids (45), Pesticides (6), Semivolatiles (6), Total Organic Carbon (95), Volatiles (6)	1
1993/1994 Sediment Source Investigation	Mar 1994	1994	KRSG	Sediment	PCB Aroclors (18), Percent Solids (18), Total Organic Carbon (6)	4
2000 Focused Sediment Sampling	May 2000	2000	KRSG	Sediment	Grain Size (6), PCB Aroclors (6), Percent Solids (6), Total Organic Carbon (6)	2
2000 Geochronological Investigation	Apr 2000	2000	KRSG	Sediment	Geochronology (55), PCB Aroclors (27), PCB Congeners (27), Percent Solids (27), Total Organic Carbon (27)	4
2000 Morrow Dam to Lake Allegan Dam Sediment Sampling	Jul 2000 - Nov 2000	2000	KRSG	Sediment	Grain Size (48), PCB Aroclors (89), PCB Congeners (17), Percent Solids (49), Total Organic Carbon (90)	4
2000 Residential Sediment Sampling	Sep 2000 - Dec 2000	2000	KRSG	Sediment	Grain Size (16), PCB Aroclors (18), Percent Solids (16), Total Organic Carbon (18)	1
Surface Water Sampling						
1993/1994 Surface Water	Jan 1994 - Sep 1994	1994	KRSG	Surface Water	Inorganics (2), PCB Aroclors (44), Pesticides (2), Semivolatiles (2), Volatiles (2), Total Suspended Solids (44)	1
1997/1998 Surface Water	May 1997	1997	KRSG	Surface Water	PCB Aroclors (1), Total Suspended Solids (1)	1
2000/2001 Surface Water Sampling	Mar 2000 - Feb 2001	2000/01	KRSG	Surface Water	PCB Aroclors (54), Total Organic Carbon (65), Total Suspended Solids (104), Dissolved Organic Carbon (13), Particulate Organic Carbon (13)	4
2007 Surface Water Sampling	Oct 2007 - Dec 2007	2007	KRSG	Surface Water	PCB Aroclors (39), Total Suspended Solids (39)	1
2008 Surface Water Sampling	Mar 2008 - Dec 2008	2008	KRSG	Surface Water	PCB Aroclors (151), Total Suspended Solids (153)	1
2009 Surface Water Sampling	Jan 2009	2009	KRSG	Surface Water	PCB Aroclors (17), Total Suspended Solids (17)	1

Georgia-Pacific LLC

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Table 3-2 -- KRSG Sample Investigation Summary

Notes:

Data categories established by USEPA (USEPA 2009):

Categories 1 and 2 – Data collected following an accepted administrative approval and oversight process. It is not required that these be flagged in the database or in report tables or figures with respect to data usability.

Category 4 – Data collected consistent with an approved QAPP and SOPs in place at the time, but without following an accepted administrative review/approval process or with field oversight. These data may be included as supplemental information with a proper flag, and when used in evaluations or reports, a brief description of the limitations should be included. These data will be flagged as follows: "Data collected without agency review or approval of work plans or field oversight."

KRSG = Kalamazoo River Study Group

PCB = polychlorinated biphenyl

USEPA = United States Environmental Protection Agency

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Table 3-3 -- MDEQ Sample Investigation Summary

Sampling Event	Approximate Sample Dates	Analysis Year	Data Source	Media	Analyses (Total Number of Samples)	Data Usability Category
Biota Sampling						
1999 LTM - Caged Fish Study	Sep 1999	1999	MDEQ	Fish	Lipids (4), PCB Congeners (4)	3
1999 LTM - Resident Fish Sampling	Oct 1999 - Nov 1999	1999	MDEQ	Fish	Lipids (27), PCB Aroclors (27), PCB Congeners (5), Solids (5)	3
1999 MDCH-NEA PCB Aroclor Fish Comparison	Oct 1999 - Nov 1999	1999	MDEQ	Fish	Lipids (5), PCB Aroclors (5), Solids (5)	3
2000 Residential Sampling	Jul 2000	2000	MDEQ	Plant	PCB Aroclors (8), Solids (8)	3
2001 LTM - Caged Fish Study	Aug 2001	2001	MDEQ	Fish	Lipids (4), PCB Congeners (8)	3
2001 LTM - Resident Fish Sampling	Aug 2001 - Sep 2001	2001	MDEQ	Fish	Dioxin/Furan (2), Lipids (29), PCB Aroclors (22), PCB Congeners (5), Solids (27)	3
2006 LTM - Resident Fish Sampling	Sep 2006	2006	MDEQ	Fish	Lipids (11), PCB Aroclors (11)	3
Semi-permeable Membrane Devices						
1999 LTM - Caged Fish Study	Sep 1999	1999	MDEQ	Sediment	PCB Congeners (3)	3
Soil Sampling						
2000 Residential Sampling	Jul 2000	2000	MDEQ	Soil	PCB Aroclors (6), Solids (6), TOC (6)	3
2000 Supplemental Residential Sampling	Sep 2000	2000	MDEQ	Soil	PCB Aroclors (13), Solids (13), TOC (13)	3
Sediment Sampling						
1999 LTM - Bedded Sediment Sampling	Dec 1999	1999	MDEQ	Sediment	PCB Congeners (1), Solids (1), TOC (1)	3
2000 USGS HASP Sampling	Aug 2000	2000	MDEQ	Sediment	Herbicides (1), Metals (1), PCB Aroclors (1), Pesticides (1), SVOCs (1), VOCs (1), Solids (1), TOC (1)	3
Surface Water Sampling						
1999 LTM - Caged Fish Study	Aug 1999 - Sep 1999	1999	MDEQ	Surface Water	PCB Congeners (6)	3
1999 LTM - Dry Weather Sampling	Sep 1999 - Oct 1999	1999	MDEQ	Surface Water	PCB Congeners (15)	3
2000 LTM - Dry Weather Sampling	Jul 2000 - Oct 2000	2000	MDEQ	Surface Water	PCB Congeners (14), TSS (14)	3
2000 LTM - Wet Weather Sampling	Apr 2000	2000	MDEQ	Surface Water	PCB Congeners (6), TSS (6)	3
2001 LTM - Caged Fish Study	Jul 2001 - Aug 2001	1999	MDEQ	Surface Water	PCB Congeners 5, TSS (5)	3

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Table 3-3 -- MDEQ Sample Investigation Summary

Sampling Event	Approximate Sample Dates	Analysis Year	Data Source	Media	Analyses (Total Number of Samples)	Data Usability Category
Surface Water Sampling (cont.)						
2001 LTM - Dry Weather Sampling	Apr 2001 - Jul 2001	2001	MDEQ	Surface Water	PCB Congeners (13), TSS (13)	3
2001 LTM - Wet Weather Sampling	Apr 2001 - Aug 2001	2001	MDEQ	Surface Water	PCB Congeners (10), TSS (10)	3
2003 LTM - Inlet/Outlet Sampling	May 2003 - Nov 2003	2003	MDEQ	Surface Water	PCB Congeners (11), TSS (11)	3
2004 LTM - Inlet/Outlet Sampling	Feb 2004 - Nov 2004	2004	MDEQ	Surface Water	PCB Congeners (16), TSS (16)	3
2005 LTM - Inlet/Outlet Sampling	Mar 2005 - Sep 2005	2005	MDEQ	Surface Water	PCB Congeners (12), TSS (12)	3
2006 LTM - Inlet/Outlet Sampling	Jan 2006 - Dec 2006	2006	MDEQ	Surface Water	PCB Congeners (16), TSS (16)	3
2007 LTM - Inlet/Outlet Sampling	Mar 2007 - Nov 2007	2007	MDEQ	Surface Water	PCB Congeners (12), TSS (12)	3
2008 LTM - Inlet/Outlet Sampling	Feb 2008 - Oct 2008	2008	MDEQ	Surface Water	PCB Congeners (16), TSS (16)	3
2009 LTM - Inlet/Outlet Sampling	Feb 2009 - Nov 2009	2009	MDEQ	Surface Water	PCB Congeners (14), TSS (14)	3
2010 LTM - Inlet/Outlet Sampling	Feb 2010 - Nov 2010	2010	MDEQ	Surface Water	PCB Congeners (19), TSS (19)	3

Notes:

Data categories established by USEPA (USEPA 2009):
Category 3 – Data collected by state and federal agencies. Data that were not collected and validated using Site-specific standard operating procedures are flagged in the database as follows: “Data may not have been collected or validated using site-specific SOPs.”

LTM = long-term monitoring
MDCH = Michigan Department of Community Health
MDEQ - Michigan Department of Environmental Quality
PCB = polychlorinated biphenyl
SVOC = semivolatile organic compounds
TOC = total organic carbon
TSS = total suspended solids
VOC = volatile organic compounds
USEPA = United States Environmental Protection Agency
USGS - Unites States Geological Survey

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Table 3-4 -- Statistical Data Summary for Total PCBs in Area 3

Dataset	Frequency of Detection	Range	Location of Max Detect	Arithmetic Mean[1] (mg/kg)	Standard Deviation[1] (mg/kg)	Geometric Mean[1] (mg/kg)	Median[1] (mg/kg)	Total Number of Samples Greater than				
								0.5 mg/kg	1.0 mg/kg	5.0 mg/kg	10 mg/kg	50 mg/kg
Sediment[2]												
All Data	142/209 (67.9%)	ND(0.054) - 160	KPT93-1 (0-2 inches)	1.6	12	0.13	0.075	39 (18.7%)	29 (13.9%)	7 (3.3%)	4 (1.9%)	2 (1.0%)
Fine	33/60 (55.0%)	ND (0.054) - 160	KPT93-1 (0-2 inches)	4.5	21	0.25	0.094	22 (36.7%)	17 (28.3%)	4 (6.7%)	4 (6.7%)	2 (3.3%)
Coarse	109/149 (73.2%)	ND (0.054) - 8.7	KP14C-6 (6-12 inches)	0.39	1.1	0.10	0.068	17 (11.4%)	12 (8.1%)	3 (2.0%)	0 (0.0%)	0 (0.0%)
Surface (All Data)	50/65 (76.9%)	ND(0.054) - 160	KPT93-1 (0-2 inches)	3.0	19	0.15	0.095	12 (18.5%)	9 (13.8%)	2 (3.1%)	2 (3.1%)	1 (1.5%)
Surface (Fine)	14/18 (77.8%)	ND(0.054) - 160	KPT93-1 (0-2 inches)	10	37	0.45	0.40	8 (44.4%)	7 (38.9%)	2 (11.1%)	2 (11.1%)	1 (5.6%)
Surface (Coarse)	36/47 (76.6%)	ND (0.054) - 4.6	KP15C-3 (0-2 inches)	0.28	0.77	0.094	0.084	4 (8.5%)	2 (4.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Subsurface (All Data)	92/144 (63.9%)	ND(0.055) - 59	KPT93-1 (2-12 inches)	0.95	5.1	0.12	0.069	27 (18.8%)	20 (13.9%)	5 (3.5%)	2 (1.4%)	1 (0.7%)
Subsurface (Fine)	19/42 (45.2%)	ND (0.056) - 59	KPT93-1 (2-12 inches)	2.2	9.2	0.19	0.075	14 (33.3%)	10 (23.8%)	2 (4.8%)	2 (4.8%)	1 (2.4%)
Subsurface (Coarse)	73/102 (71.6%)	ND (0.055) - 8.7	KP14C-6 (6-12 inches)	0.43	1.3	0.10	0.065	13 (12.7%)	10 (9.8%)	2 (2.9%)	0 (0.0%)	0 (0.0%)
Floodplain Soil[3]												
All Data	139/179 (77.7%)	ND (0.053) - 120	OES5-6 (6-18 inches)	8.9	17	1.2	1.9	112 (62.6%)	103 (57.5%)	68 (38.0%)	42 (23.5%)	5 (2.8%)
Surface	37/53 (69.8%)	ND (0.054) - 61	FF-67 (0-6 inches)	8.3	12	1.0	2.2	32 (60.4%)	30 (56.6%)	24 (45.3%)	14 (26.4%)	1 (1.9%)
Subsurface	102/126 (81.0%)	ND (0.053) - 120	OES5-6 (6-18 inches)	9.1	19	1.3	1.8	80 (63.5%)	73 (57.9%)	44 (34.9%)	28 (22.2%)	4 (3.2%)
Pine Creek Sediment[4]												
All Data	3/6 (50.0%)	ND (0.064) - 16	FF-66 (6-12 inches)	2.7	6.4	0.18	0.072	1 (16.7%)	1 (16.7%)	1 (16.7%)	1 (16.7%)	0 (0.0%)
Surface	0/1 (0.0%)	ND (0.14)	--	--	--	--	--	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Subsurface	3/5 (60.0%)	ND (0.064) - 16	FF-66 (6-12 inches)	3.2	7.0	0.22	0.074	1 (20.0%)	1 (20.0%)	1 (20.0%)	1 (20.0%)	0 (0.0%)

Notes:

1. One-half the detection limit was used as a proxy concentration for non-detects.
2. Data includes samples collected during 1993/1994 Sediment Investigation and 2000 SRI Morrow Dam to Lake Allegan Dam Sediment Sampling.
3. Data includes samples collected during 1993 Floodplain Investigation, 1993/1994 Former Impoundment Sediment Investigation, and 2000 SRI Focused Sediment Sampling.
4. The data includes focused sediment samples collected at location FF-66 in 2000, located in the northwest corner of the Pine Creek (outside the primary Area 3 Impoundment).
5. Parent/duplicate samples were averaged prior to analysis.
6. mg/kg = milligrams per kilogram

Georgia-Pacific LLC

Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

Area 3/Former Otsego Impoundment Supplemental Remedial Investigation/Feasibility Study Work Plan

Table 4-1 -- Existing PCB Data for Fish

Species	Tissue	Sample Year	Sampler	Frequency of Detection	Range	Arithmetic Mean (mg/kg)	Geometric Mean (mg/kg)	Median (mg/kg)
Carp	Fillet	1993	ARCADIS (BBL)	11/11 (100%)	0.56 J - 6.4	2.7	2.1	2.6
		1999	State	11/11 (100%)	0.29 - 4.9	2.5	2.0	2.7
		2001	State	11/11 (100%)	1.4 - 50	9.0	5.5	5.4
		2006	State	11/11 (100%)	0.49 - 2.3	1.4	1.2	1.4
		2009	ARCADIS	11/11 (100%)	0.11 J - 7.3	2.9	1.7	2.7
Smallmouth Bass	Fillet	1993	ARCADIS (BBL)	11/11 (100%)	0.39 - 3.7 J	1.5	1.2	1.4
		1999	State	11/11 (100%)	0.31 - 1.1	0.58	0.55	0.56
		2001	State	11/11 (100%)	0.32 - 1.1	0.63	0.59	0.58
		2009	ARCADIS	11/11 (100%)	0.15 - 0.80 J	0.44	0.38	0.32
Smallmouth Bass	Whole Body (Composite)	1999	State	5/5 (100%)	2.4 - 2.8	2.6	2.6	2.5
Sucker	Whole Body	1993	ARCADIS (BBL)	11/11 (100%)	1.5 J - 2.8	2.1	2.1	2.1

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Area 3/Former Otsego Impoundment SRI/FS Work Plan

Table 5-1 -- Types of Field Reconnaissance Observations to be Collected as a Guide to Sampling Plan Development

Type	Approach
Soil Characteristics	
Texture	Visual – Personnel will note soil type and texture. Personnel will also use the approaches described in the Corps of Engineers Wetland Delineation Manual to describe and estimate the organic content of the soil. [1] Personnel will use a hand auger to depths of up to 3 feet in some areas to better describe soils.
Color	Munsell Soil Color Chart
Saturation	Visual – look for degree of saturation of the soils and note areas and depths of standing water.
Vegetation Cover	Visual – identify dominant types of vegetation and approximate extents of ground cover.
Water marks	Visual – note locations of apparent water marks. These marks may assist in better defining edges of terraces.
Sediment Characteristics	
Overlying water depth	Calibrated rod and distance measuring device – In-side channels, personnel will note water depth (and location) at regular intervals along transect lines, along with edge of water locations.
Texture	Visual and feel – note soil type and texture. Record locations of any observed extensive deposits of sediments in the side channels with predominantly clays and silts. May include use of lexan tubes as necessary to further characterize areas of interest.
Depositional Areas	Visual – look for areas of fine sediment deposits above and below water surface and note coordinates and approximate dimensions of these areas. May include probing using a steel rod to determine approximate thickness of deposits.
Relative flow velocity	Visual – qualitatively note local flow conditions in the local areas of deposits that may be identified and record these qualitatively as part of the description of the area.

Notes:

1. Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Waterways Experiment Station, Vicksburg, Mississippi. Technical Report Y-87-1. This document describes three types of organic soils:
   - 01 – organic matter consisting of visible vegetative matter
   - 02 – organic matter in a form where individual components are unrecognizable to the naked eye
   - A1 – decomposed organic matter mixed with mineral matter

   Percent and type of organic matter in soil are based on visual assessment

ARCADIS

Figures

City of Saugatuck
Kalamazoo Lake
City of Douglas
Lake Michigan
City of Fennville
Area 7
ALLEGAN DAM
Area 6
Lake Allegan
City of Allegan
ALLEGAN CITY DAM
TROWBRIDGE DAM
Area 5
OTSEGO DAM
Area 4
Area 3
City of Otsego
OTSEGO CITY DAM
FORMER PLAINWELL DAM
Area 2
City of Plainwell
PLAINWELL DAM #2
Area 1
City of Wayland
Village of Hopkins
Village of Martin
Village of Bloomingdale
Village of Breedsville
City of Gobles
City of Bangor
Village of Richland
City of Parchment
Morrow Lake
MORROW DAM
City of Kalamazoo

LAKE SUPERIOR
LAKE HURION
LAKE MICHIGAN
ALLEGAN COUNTY
LAKE ERIE
MICHIGAN

LEGEND:
- DAM LOCATION (AND SRI/FS AREA BOUNDARY)
- ROAD
- TOWNSHIP BOUNDARY
- INCORPORATED AREA
- WATERSHED BOUNDARY

TOPOGRAPHY
ELEVATION (FT):
HIGH : 1125
LOW : 577

NOTE:
1. IMAGERY DOWNLOADED FROM THE MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION.

0 4 8 Miles
GRAPHIC SCALE

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

KALAMAZOO RIVER SUPERFUND SITE

ARCADIS

FIGURE
1-1

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCityDam ToOtsegoDam\SRIFS_WorkPlan\mxd\Site Map - Entire Study Area.mxd 3/22/2012 4:00:15 PM

OTSEGO DAM

OTSEGO CITY DAM

106TH AVE

104TH AVE

HARTER DR

RIVER RD

OLD ALLEGAN-OTSEGO RD

19TH ST

LINCOLN RD

JEFFERSON RD

MORTER RD

EARL ST

18TH ST

19TH ST

THOREAU CT

WALDEN DR

ASHLAND DR

21ST ST

UNKNOWN

UNKNOWN

CATHERINE ST

JOHN ST

WATSON RD

N 16TH ST

15TH ST

FLORENCE ST

HIGHLAND ST

FAIRVIEW ST

E RIVER ST

HELEN AVE

N NORTH ST

WATER ST

WATER ST

N GRANT ST

S SHERMAN ST

S GRANT ST

SHERWOOD ST

W ALLEGAN ST

W ORLEANS ST

E FRANKLIN ST

MURIEL ST

E MORRELL ST

W HAMMOND ST

LINCOLN ST

GARFIELD ST

MCKINLEY ST

WASHINGTON ST

GRANT ST

CONFERENCE ST

S NORTH ST

N FAIR ST

COURT ST

JEWELL ST

E ALLEGAN ST

E ORLEANS ST

W FRANKLIN ST

S WILMOTT ST

E HAMMOND ST

S PLATT ST

KALAMAZOO ST

N FARMER ST

S FAIR ST

CHARLES ST

DIX ST

IRWING ST

TEMPLE ST

ALLEN ST

BAYBERRY LN

HOWARD ST

TANGLEWOOD DR

OAK ST

SYCAMORE ST

CONFERENCE ST

ELM ST

S 16TH ST

16TH ST

UNKNOWN

SYCAMORE ST

0 1,100 2,200 Feet

GRAPHIC SCALE

LEGEND:

- EXISTING SHORELINE (APPROXIMATE)
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY
- ROAD CENTERLINE (APPROXIMATE)
- 683 FT CONTOUR

TOPOGRAPHIC ELEVATIONS (FT NGVD29):

- < 676
- 676 - 678
- 678 - 680
- 680 - 682
- 682 - 684
- 684 - 686
- 686 - 688
- 688 - 690
- > 690

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. STUDY AREA BOUNDARY DERIVED FROM OUTER EXTENT OF FEMA 100-YEAR FLOODPLAIN BOUNDARY, 683 FEET NGVD29 FORMER IMPOUNDMENT ELEVATION, AND VISUALLY IDENTIFIED IMPOUNDED AREAS FROM HISTORICAL PHOTOGRAPHS

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

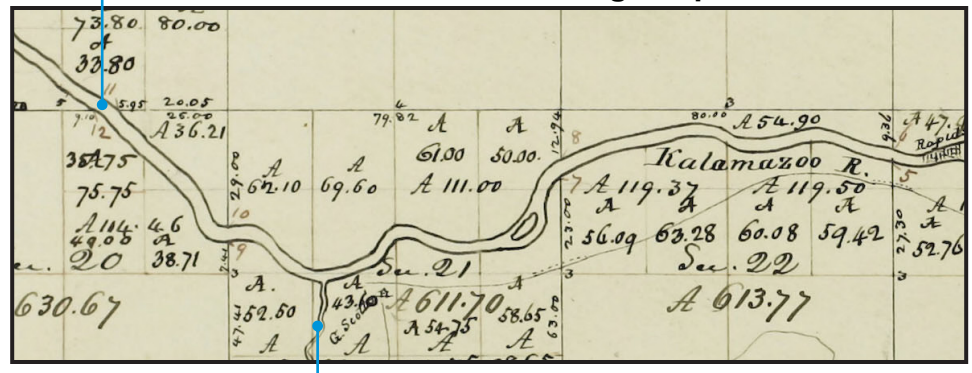
AREA 3 SITE MAP

ARCADIS

FIGURE
2-1

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCity\DamTo\OtsegoDam\SRIFS_WorkPlan\mxd\Site Map - Area 3_v6.mxd 3/22/2012 4:04:12 PM

Otsego Impoundment - 1850



NOTE:
Map taken 1850
(Source: Michigan Department of Natural Resources).

Otsego Impoundment - 1873

NOTE:
Map taken 1873
(Source: David Rumsey Historical Map Collection).

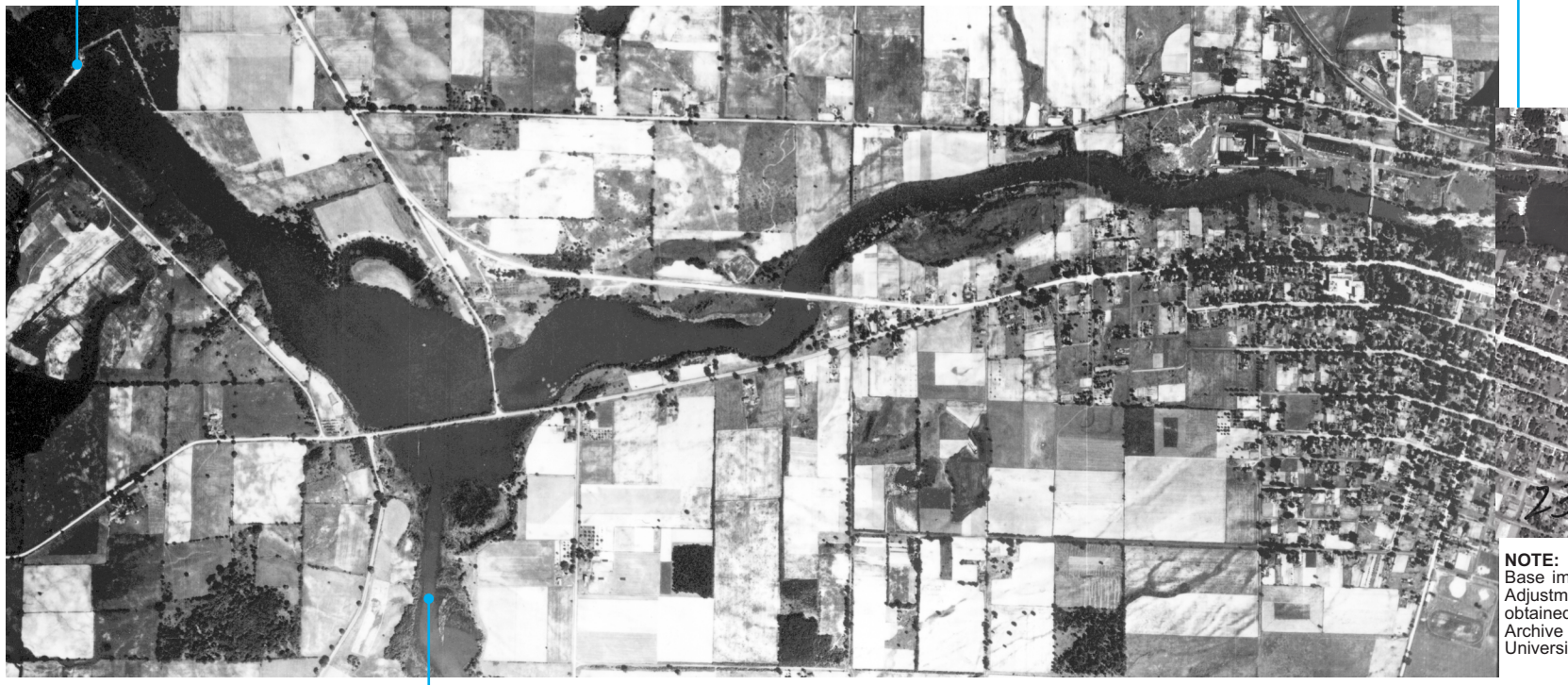
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL MAPS 1850 AND 1873

ARCADIS

FIGURE
2-2a

Otsego Impoundment - 1938



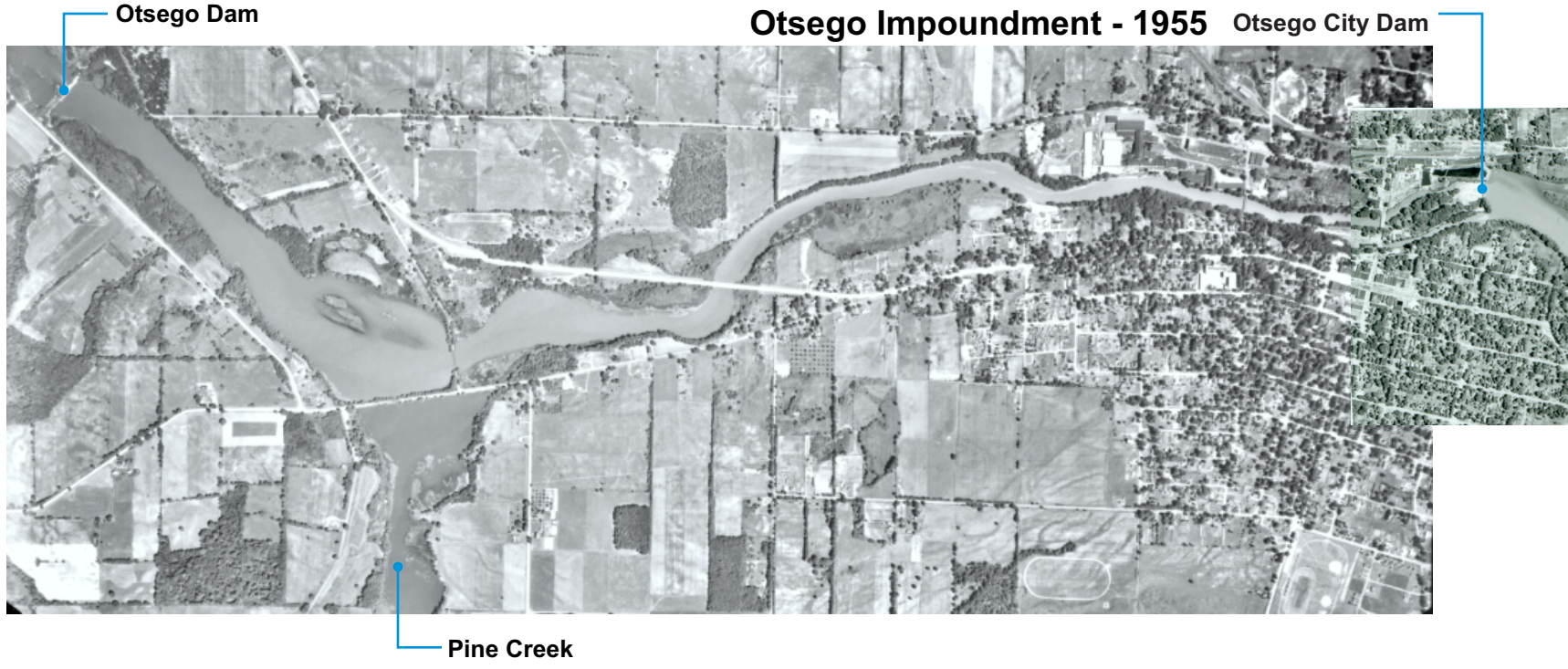
NOTE:
Base image from Agricultural Adjustment Administration (1938), obtained from Aerial Imagery Archive at Michigan State University.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1938

ARCADIS

FIGURE
2-2b



NOTE:
1. Aerial photograph taken August 11, 1955.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1955

ARCADIS

FIGURE
2-2c

NOTE:
Aerial photograph taken June 4, 1960.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1960

ARCADIS

FIGURE
2-2d

NOTE:
1. Aerial photograph taken September 22, 1967.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1967

ARCADIS

FIGURE
2-2e

NOTE:
1. Aerial photograph taken October 10, 1974.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1974

ARCADIS

FIGURE
2-2f

Otsego Impoundment - 1986

NOTE:
1. Aerial photograph taken August 30, 1986.

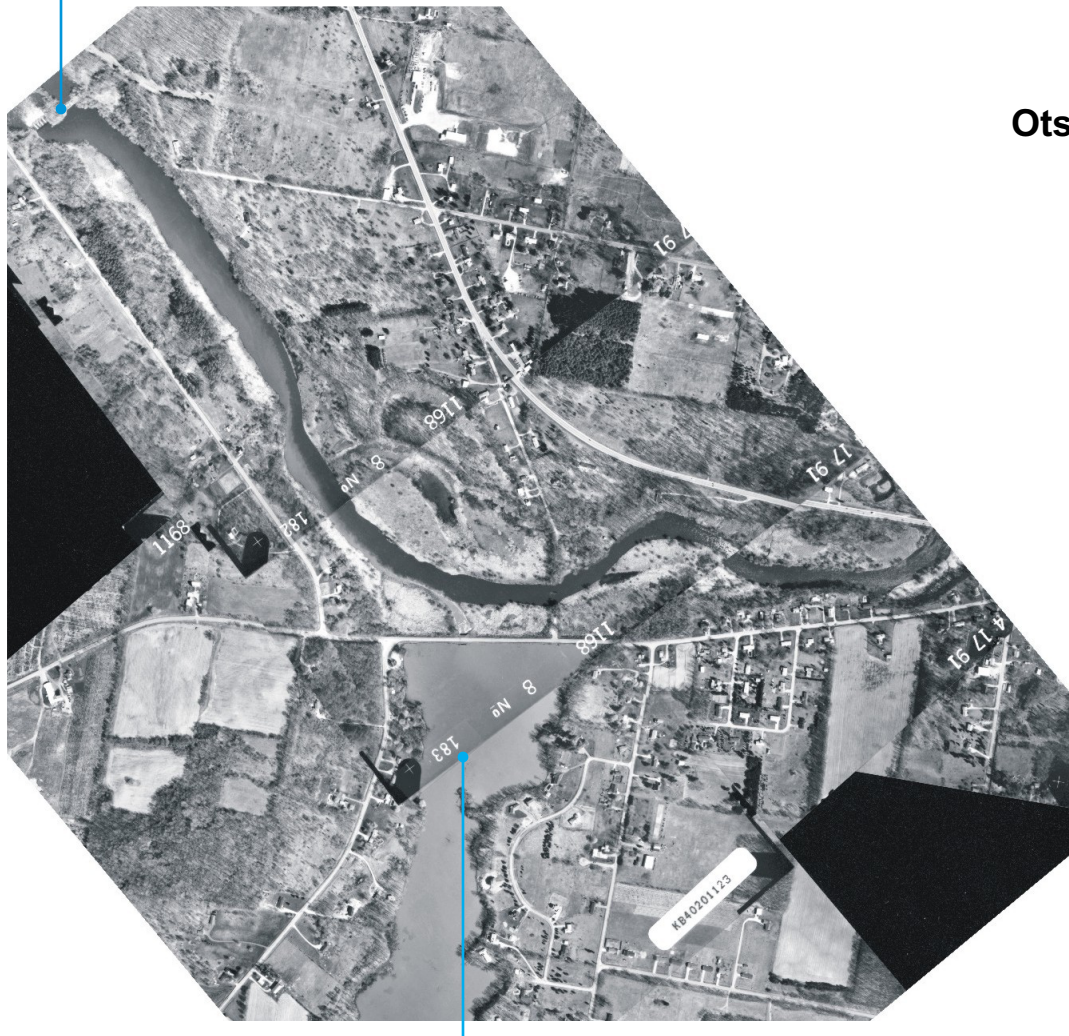
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1986

ARCADIS

FIGURE
2-2g

Otsego Dam



Pine Creek

Otsego Impoundment - 1991

Otsego City Dam

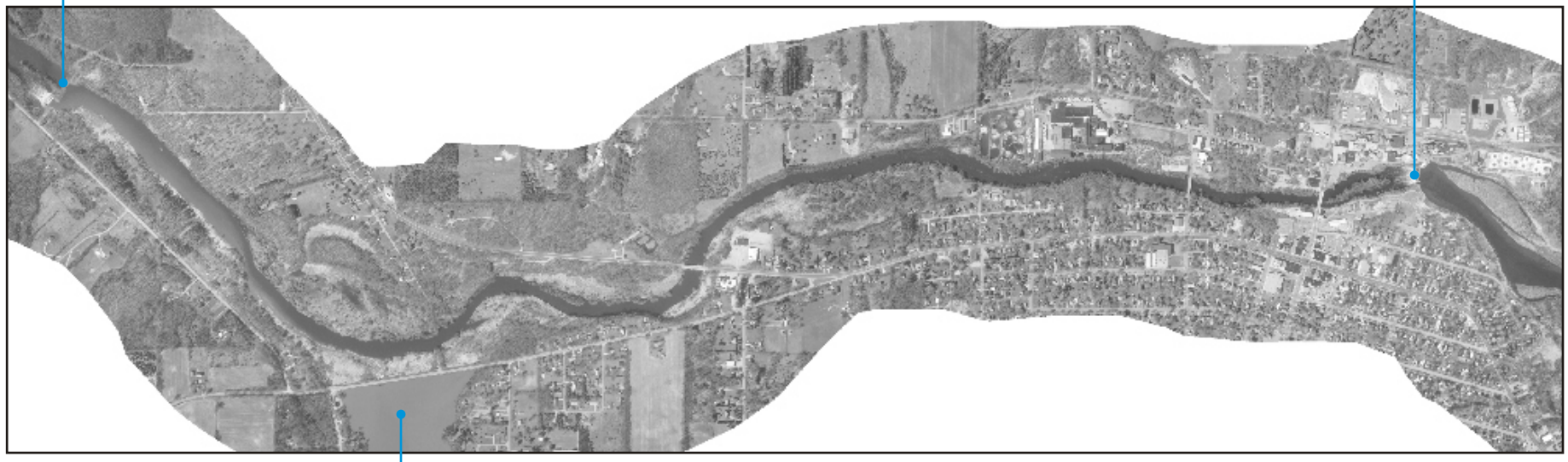
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1991

ARCADIS

FIGURE
2-2h

Otsego Impoundment - 1999



NOTE:
1. Aerial photograph taken April 24, 1999 by Air Land Surveys, Inc.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 HISTORICAL AIR PHOTOS - 1999

ARCADIS

FIGURE
2-2i

LEGEND:

- EXISTING SHORELINE (APPROXIMATE)
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY

TOP OF SEDIMENT ELEVATIONS:

- 662 - 666
- 666 - 670
- 670 - 674
- 674 - 678
- 678 - 682
- 682 - 686
- > 686

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. TOP OF SEDIMENT ELEVATIONS REPORTED IN FEET REFERENCED TO NGVD29.
3. TOP OF SEDIMENT ELEVATION DERIVED FROM BATHYMETRIC DATA SURVEYED BY OSI IN 2000 AND CORING AND PROBING DATA COLLECTED BY KRSG IN 1993/1994 AND 2000 AND USGS IN 2000.

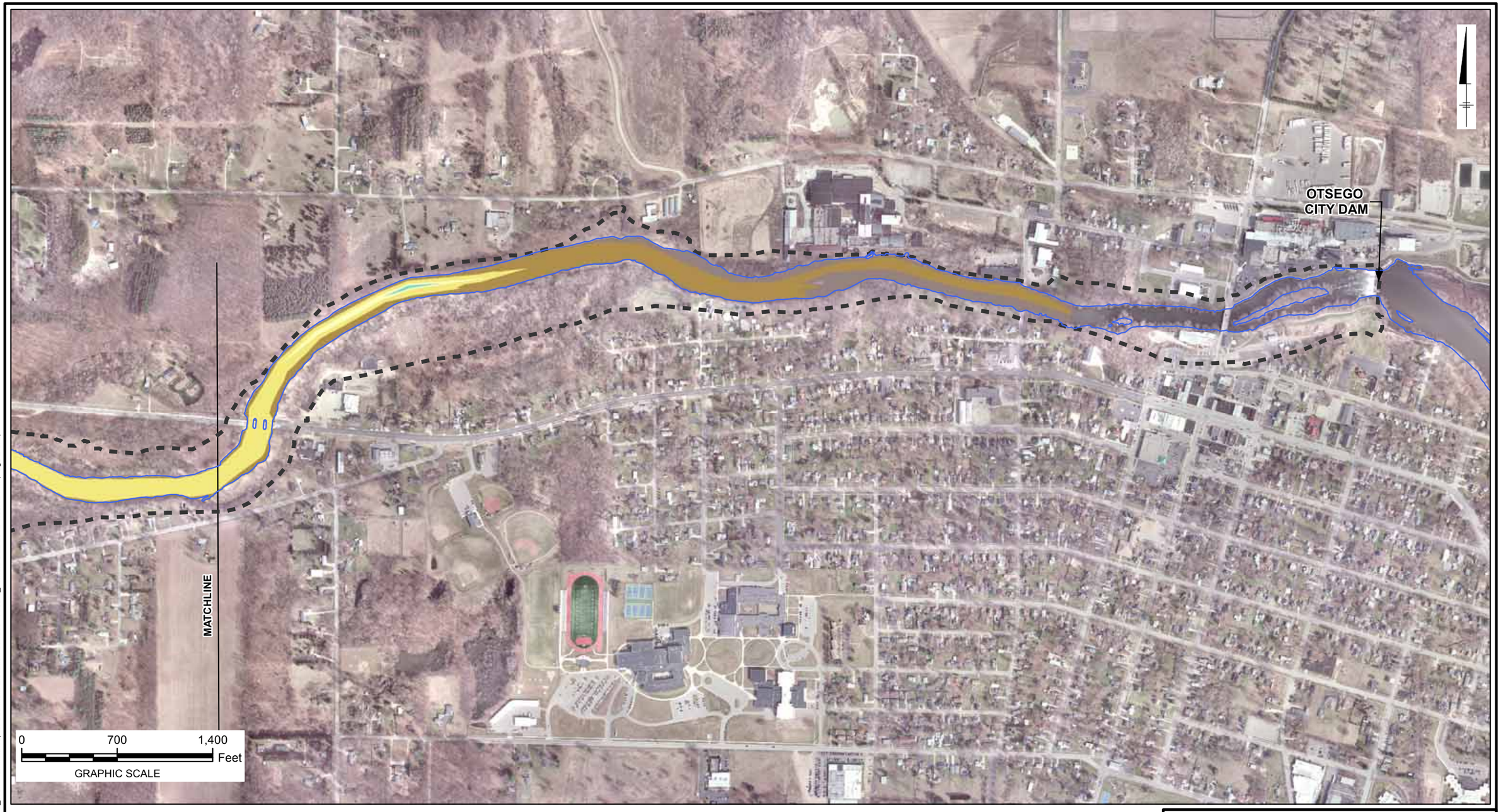
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

TOP OF SEDIMENT ELEVATION SURFACE IN AREA 3

ARCADIS

FIGURE
2-3a

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCityDam1\OtsegoDam\SRIFS_WorkPlan\mxd\Top of Sediment Elevation Surface - Area 3_v4.mxd 3/22/2012 4:05:12 PM (Page 1 of 2)



LEGEND:

- EXISTING SHORELINE (APPROXIMATE)
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY

TOP OF SEDIMENT ELEVATIONS:

- 662 - 666
- 666 - 670
- 670 - 674
- 674 - 678
- 678 - 682
- 682 - 686
- > 686

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. TOP OF SEDIMENT ELEVATIONS REPORTED IN FEET REFERENCED TO NGVD29.
3. TOP OF SEDIMENT ELEVATION DERIVED FROM BATHYMETRIC DATA SURVEYED BY OSI IN 2000 AND CORING AND PROBING DATA COLLECTED BY KRSG IN 1993/1994 AND 2000 AND USGS IN 2000.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

TOP OF SEDIMENT ELEVATION SURFACE IN AREA 3

ARCADIS

FIGURE
2-3b

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCity\DamToOtsegoDam\SRIFS_WorkPlan\mxd\Top of Sediment Elevation Surface - Area 3_v4.mxd 3/22/2012 4:05:12 PM (Page 2 of 2)

LEGEND:

- EXISTING SHORELINE (APPROXIMATE)
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY

SEDIMENT THICKNESS (FT)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 14

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. SEDIMENT THICKNESS REPORTED IN FEET REFERENCED TO NGVD29.
3. SEDIMENT THICKNESS DERIVED FROM SEDIMENT PROBING DATA COLLECTED BY KRSG IN 1993/1994 AND 2000 AND USGS IN 2000.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

SEDIMENT THICKNESS IN AREA 3

ARCADIS

FIGURE
2-4a

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCityDam1\OtsegoDam\SRIFS_WorkPlan\mxd\Sediment Thickness Surface - Area 3_v3.mxd 3/22/2012 4:07:40 PM (Page 1 of 2)

LEGEND:

- EXISTING SHORELINE (APPROXIMATE)
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY

SEDIMENT THICKNESS (FT)

- 0 - 2
- 2 - 4
- 4 - 6
- 6 - 8
- 8 - 10
- 10 - 12
- 12 - 14

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. SEDIMENT THICKNESS REPORTED IN FEET REFERENCED TO NGVD29.
3. SEDIMENT THICKNESS DERIVED FROM SEDIMENT PROBING DATA COLLECTED BY KRSG IN 1993/1994 AND 2000 AND USGS IN 2000.

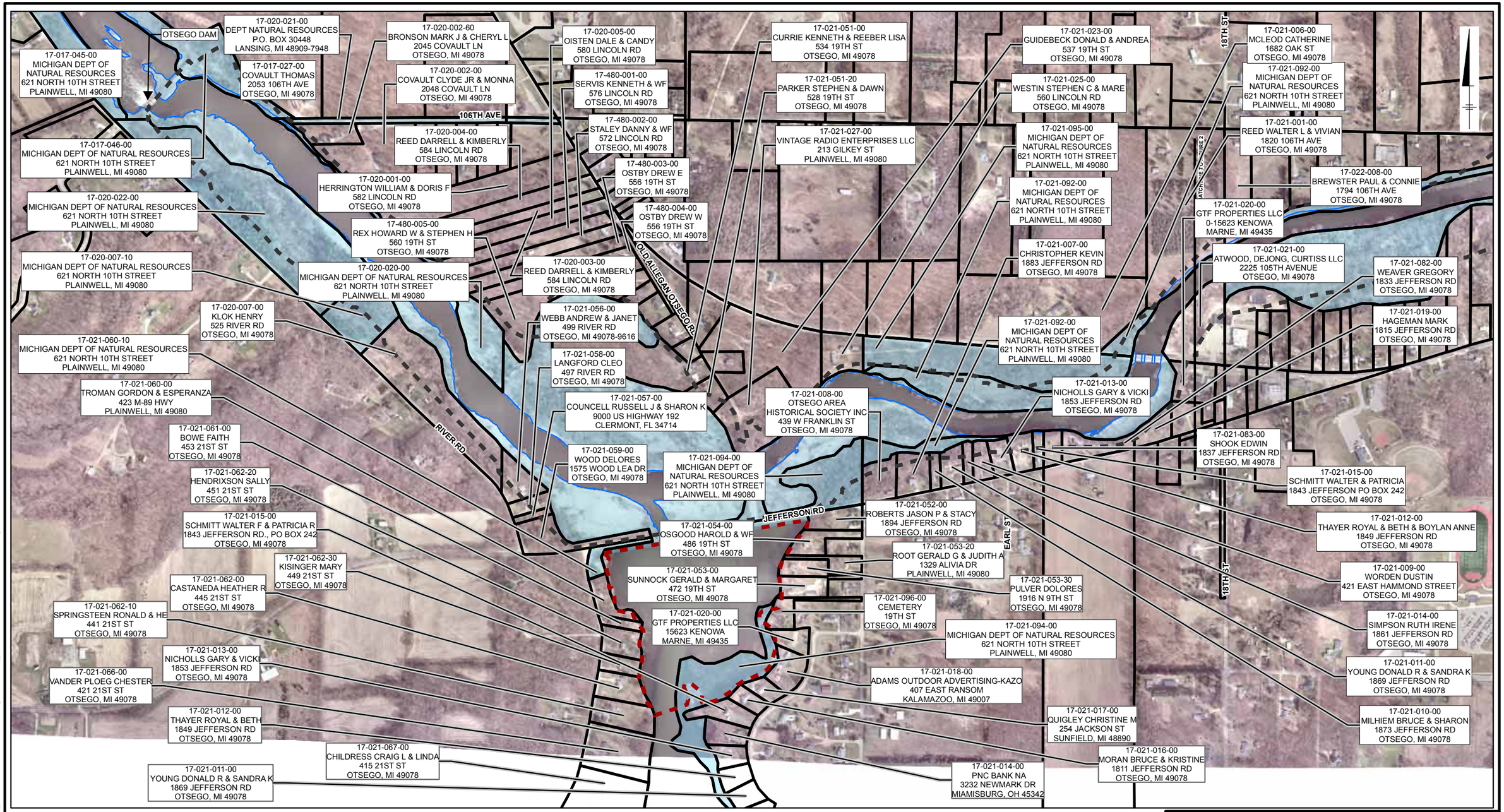
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

SEDIMENT THICKNESS IN AREA 3

ARCADIS

FIGURE
2-4b

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCityDam1\OtsegoDam\SRIFS_WorkPlan\mxd\Sediment Thickness Surface - Area 3_v3.mxd 3/22/2012 4:07:40 PM (Page 2 of 2)



LEGEND:

- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY
- PARCEL BOUNDARY
- SHORELINE
- APPROXIMATE AREA OWNED BY MDNR
- APPROXIMATE AREA OWNED BY CITY OF OTSEGO

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. PARCEL BOUNDARIES PROVIDED BY ALLEGAN COUNTY.
3. LAND ADJACENT TO RIVER, NOT IDENTIFIED BY ALLEGAN COUNTY, ASSUMED TO BE OWNED BY MDNR.

17-021-059-00
WOOD DELORES
1575 WOOD LEA DR
OTSEGO, MI 49078

- TAX PARCEL ID
- OWNER NAME (LAST NAME, FIRST NAME)
- OWNER STREET ADDRESS
- OWNER CITY, STATE & ZIP CODE

0 700 1,400 Feet

GRAPHIC SCALE

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

TAX PARCELS RELATED TO AREA 3

ARCADIS

FIGURE 2-5a

City: SYR_Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0006431.0002.00500)
Q:\KRSG\OtsegoCityDam\ToOtsegoDam\SRIFS_WorkPlan\mxd\Parcels Otsego1 - Area 3_v4.mxd 3/22/2012 4:10:04 PM (Page 1 of 1)

17-022-003-00
BIGELOW MICHAEL K
1750 106TH AVE
OTSEGO, MI 49078

17-022-005-00
VANMEER CORPORATION
1754 106TH ST
OTSEGO, MI 49078

17-022-004-00
BREWSTER LEWIS & CAROL
1794 106TH AVE
OTSEGO, MI 49078

17-022-006-00
GILLILAND DARL L
1772 106TH AVE
OTSEGO, MI 49078

17-022-007-00
NICKERSON WILLIAM & MARJORIE
1768 106TH AVE
OTSEGO, MI 49078

17-022-026-00
REISING SCOTT E & VICKY D
731 NICHOLSON ST
OTSEGO, MI 49078

17-022-025-00
DEJONG ROBERT &ATWOOD DENISE
2225 105TH AVE
OTSEGO, MI 49078-9663

17-022-002-10
KIBLER GEORGE & CHARLINE TRUST
2525 WEST F AVE
KALAMAZOO, MI 49009

17-022-002-00
MORGAN MICHAEL & DIANE
1236 111TH AVE
MARTIN, MI 49070

17-022-065-00
MICHIGAN DEPT OF
NATURAL RESOURCES
621 NORTH 10TH STREET
PLAINWELL, MI 49080

17-022-001-00
HUYCK PENNY
1736 106TH AVE
OTSEGO, MI 49078

17-022-065-00
MICHIGAN DEPT OF
NATURAL RESOURCES
621 NORTH 10TH STREET
PLAINWELL, MI 49080

54-022-196-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-022-029-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-150-009-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-150-008-00
ROBIDOUX DALE F & DOROTHY
518 WATER ST
OTSEGO, MI 49078

54-150-007-00
PECKENS VERNON
510 WATER ST
OTSEGO, MI 49078

54-022-039-00
DETTMANN JONATHAN
506 WATER ST
OTSEGO, MI 49078

54-022-040-00
MARLOW CHARLES E & SHARON L
24600 31ST ST
GOBLES, MI 49055-8702

54-022-041-11
LICK STEVEN J
438 W WATER
OTSEGO, MI 49078

54-022-042-10
JONES DANNY
434 WATER
OTSEGO, MI 49078

54-022-044-00
KNIGHT DARYL & KATHY
420 W ALLEGAN ST
OTSEGO, MI 49078

54-022-045-00
BRONSON ELWIN & VIRGINIA
404 W ALLEGAN ST
OTSEGO, MI 49078

54-250-047-00
ROBINSON WILLIAM & PATRICIA
12007 OAKRIDGE RD P O BOX 493
PLAINWELL, MI 49080

54-022-003-00
ROBINSON WILLIAM & PATRICIA
12007 OAKRIDGE RD , P O BOX 493
PLAINWELL, MI 49080

54-022-005-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-023-041-00
CRONEN LYNDON L & CARMEN L
5180 GRAND ARBRE TRAIL
KALAMAZOO, MI 49009

54-022-006-10
SCHANZ MARION & SHIRLEY
3089 102ND AVE
ALLEGAN, MI 49010

54-015-006-00
COGSWELL PROPERTY LLC
PO BOX 363
OTSEGO, MI 49078

54-022-007-00
BRONSON JOSEPH P & KECIA P
378 W ALLEGAN
OTSEGO, MI 49078

54-202-005-00
MEAD KYLE V
205 N MAIN ST
OTSEGO, MI 49078

54-022-008-00
THOMPSON JOEL M
217 KALAMAZOO
OTSEGO, MI 49078

54-022-009-00
ADAMS TODD S & MARTHA A
669 GLENVIEW CIRCLE
PLAINWELL, MI 49080

54-022-013-00
TOWN RAYMOND TRUST
354 WATER ST
OTSEGO, MI 49078

54-022-014-00
TOWN RAYMOND TRUST
354 WATER ST
OTSEGO, MI 49078

54-022-012-00
MARTENS JOHN
346 W WATER ST
OTSEGO, MI 49078

54-022-023-00
HARRIS DONALD JR
334 W WATER ST
OTSEGO, MI 49078

54-250-034-50
CITY OF OTSEGO
117 ORLEANS ST
OTSEGO, MI 49078

54-100-001-00
WASHOUT LLC
3313 STADIUM DR
KALAMAZOO, MI 49008

54-500-009-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-023-030-00
OTSEGO PAPER INC
320 N FARMER ST
OTSEGO, MI 49078

54-500-012-00
CITY OF OTSEGO
117 E ORLEANS ST
OTSEGO, MI 49078

54-101-010-70
HAUGH RICHARD W & JUDITH K
1418 HILLCREST DR
HOPKINS, MI 49328

54-250-034-00
CITY OF OTSEGO
117 ORLEANS ST
OTSEGO, MI 49078

54-023-030-00
OTSEGO PAPER INC
320 N FARMER ST
OTSEGO, MI 49078

54-023-033-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-023-040-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-201-001-00
CRONEN GERENE
256 W ALLEGAN ST
OTSEGO, MI 49078

54-201-002-00
STEELE DALAURA
260 W WATER ST
OTSEGO, MI 49078

54-201-003-00
LAKEMAN EARL & MARGIE LIFE
673 BROOKSIDE APT 2
OTSEGO, MI 49078

54-201-004-00
MOSS BONNIE J
9625 MARSH RD
PLAINWELL, MI 49080

54-202-007-00
WRIGHT JEFFREY T & JENNIFER
308 WATER ST
OTSEGO, MI 49078

54-202-008-50
THOMAS ROBERT D & WF
324 WATER
OTSEGO, MI 49078

54-022-025-00
THOMAS ROBERT D & WF
324 WATER
OTSEGO, MI 49078

54-101-006-00
ST MARGARETS PARRISH
245 COURT
OTSEGO, MI 49078

54-023-042-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-100-115-00
CITY OF OTSEGO
117 E ORLEANS
OTSEGO, MI 49078

54-250-034-20
CITY OF OTSEGO
117 ORLEANS ST
OTSEGO, MI 49078

54-500-011-00
DUSSIA JOHN O & CASIE LYNN
228 JEWELL ST
OTSEGO, MI 49078

54-023-039-00
MILLASSIST SERVICES INC
141 N FARMER
OTSEGO, MI 49078

54-500-006-00
LIVINGSTON ROBERT D
228 JEWELL ST
OTSEGO, MI 49078

106TH AVE
E RIVER ST
LINCOLN RD
JEFFERSON RD
MATCHLINE TO FIGURE 1
SHERWOOD ST
E FRANKLIN ST
WATSON RD
FLORENCE ST
HELEN AVE
W ALLEGAN ST
E ALLEGAN ST
OTSEGO CITY DAM
COURT ST
N WILMOT ST
E ORLEANS ST
W FRANKLIN ST

LEGEND:

- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY
- PARCEL BOUNDARY
- SHORELINE
- APPROXIMATE AREA OWNED BY CITY OF OTSEGO
- APPROXIMATE AREA OWNED BY MDNR

NOTES:

1. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. PARCEL BOUNDARIES PROVIDED BY ALLEGAN COUNTY.
3. LAND ADJACENT TO RIVER, NOT IDENTIFIED BY ALLEGAN COUNTY, ASSUMED TO BE OWNED BY MDNR.

17-021-059-00 — TAX PARCEL ID
WOOD, DELORES — OWNER NAME (LAST NAME, FIRST NAME)
1575 WOOD LEA DR — OWNER STREET ADDRESS
OTSEGO, MI 49078 — OWNER CITY, STATE & ZIP CODE

0 600 1,200 Feet
GRAPHIC SCALE

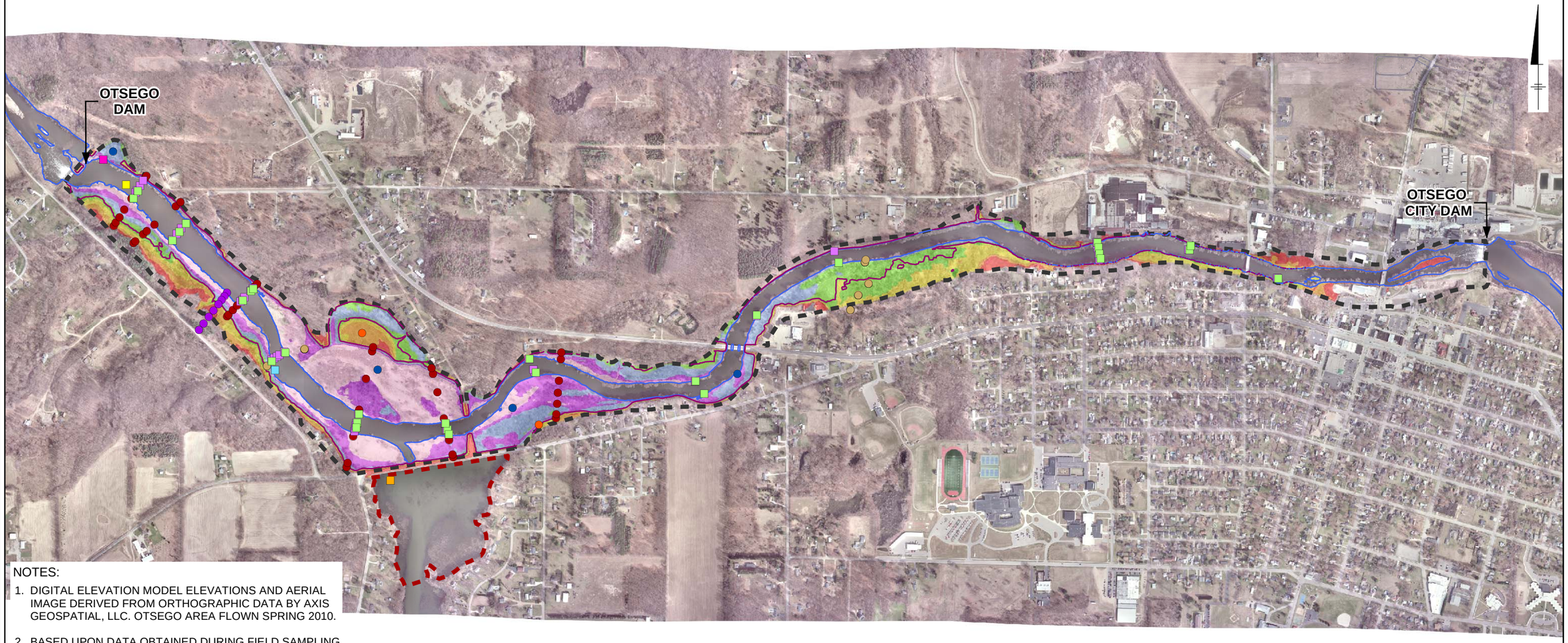
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

TAX PARCELS RELATED TO AREA 3

ARCADIS

FIGURE
2-5b

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCityDamToOtsegoDam\SRIFS_WorkPlan\mxd\Parcels Otsego2 - Area 3_v3.mxd 3/22/2012 4:11:26 PM (Page 1 of 1)



NOTES:

1. DIGITAL ELEVATION MODEL ELEVATIONS AND AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. BASED UPON DATA OBTAINED DURING FIELD SAMPLING PERFORMED BY ARCADIS IN 1993/1994 AND 2000, AND BY MDEQ IN 2000.
3. A NUMBER OF CORES ARE CO-LOCATED WITH CORES FROM OTHER ARCADIS INVESTIGATIONS. IN EACH OF THESE CASES, THE MOST RECENT SAMPLE EVENT IS INDICATED.
4. DATA FOR MDEQ 2000 RESIDENTIAL SAMPLING EVENT PROVIDED BY MDEQ IN THEIR MOST RECENT DATABASE SUBMITTAL ON MAY 27, 2011. FOUR SAMPLE IDS (GARD1-1, RRA-5, RRA-7, AND RRA-8) APPEAR CO-LOCATED BASED ON REPORTED SURVEY.

0 1,100 2,200 Feet

GRAPHIC SCALE

LEGEND:

SEDIMENT SAMPLE EVENT:
- 1993/1994 SEDIMENT INVESTIGATION
- 2000 FOCUSED SEDIMENT SAMPLING
- 2000 GEOCHRONOLOGICAL INVESTIGATION
- 2000 MORROW DAM TO LAKE ALLEGAN DAM SEDIMENT SAMPLING
- 1999 LTM BEDDED SEDIMENT SAMPLING (MDEQ)
- 2000 USGS SEDIMENT SAMPLING (MDEQ)

SOIL SAMPLE EVENT:
- 1993 FLOODPLAIN INVESTIGATION
- 1993 TERRESTRIAL BIOTA INVESTIGATION
- 1993/1994 FORMER IMPOUNDMENT SEDIMENT INVESTIGATION
- 2000 FOCUSED SEDIMENT SAMPLING
- 2000 RESIDENTIAL SAMPLING (MDEQ)

- 683 FT CONTOUR
- EXISTING SHORELINE (APPROXIMATE)
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY

TOPOGRAPHIC ELEVATIONS (FT NGVD29):
- < 676
- 676 - 678
- 678 - 680
- 680 - 682
- 682 - 684
- 684 - 686
- 686 - 688
- 688 - 690
- > 690

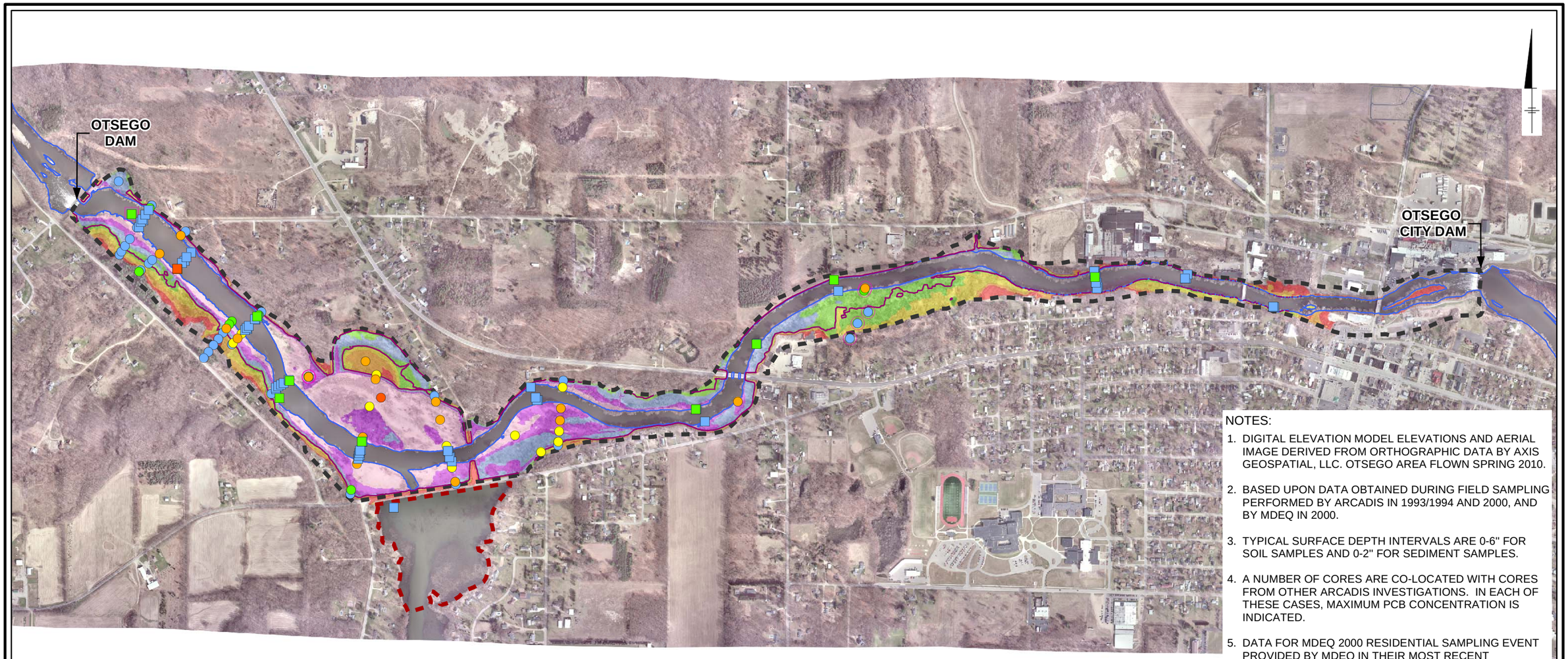
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 DATA COLLECTED TO DATE

ARCADIS

FIGURE
3-1

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
K:\RSG\B0064531\0002.00500\
Q:\KRSG\OtsegoCityDam\TO\OtsegoDam\SRIFS_WorkPlan\mxd\Existing Data - Area 3_v5.mxd 3/22/2012 4:12:45 PM



NOTES:

1. DIGITAL ELEVATION MODEL ELEVATIONS AND AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. BASED UPON DATA OBTAINED DURING FIELD SAMPLING PERFORMED BY ARCADIS IN 1993/1994 AND 2000, AND BY MDEQ IN 2000.
3. TYPICAL SURFACE DEPTH INTERVALS ARE 0-6" FOR SOIL SAMPLES AND 0-2" FOR SEDIMENT SAMPLES.
4. A NUMBER OF CORES ARE CO-LOCATED WITH CORES FROM OTHER ARCADIS INVESTIGATIONS. IN EACH OF THESE CASES, MAXIMUM PCB CONCENTRATION IS INDICATED.
5. DATA FOR MDEQ 2000 RESIDENTIAL SAMPLING EVENT PROVIDED BY MDEQ IN THEIR MOST RECENT DATABASE SUBMITTAL ON MAY 27, 2011. FOUR SAMPLE IDS (GARD1-1, RRA-5, RRA-7, AND RRA-8) APPEAR CO-LOCATED BASED ON REPORTED SURVEY; THEREFORE, ONLY THE MAXIMUM CONCENTRATION IS SHOWN ON THIS FIGURE. DEPTH INTERVALS WERE NOT IDENTIFIED FOR FOUR SAMPLE IDS (RRA-1, RRA-5, RRA-7, AND RRA-8) AND ARE THEREFORE ASSUMED TO BE SURFACE SAMPLES.

0 1,100 2,200 Feet

GRAPHIC SCALE

LEGEND:

SURFACE SEDIMENT PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SEDIMENT SAMPLE LOCATION

SURFACE SOIL PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SOIL SAMPLE LOCATION (SEE NOTE 5)

- 683 FT CONTOUR
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY
- EXISTING SHORELINE (APPROXIMATE)

TOPOGRAPHIC ELEVATIONS (FT NGVD29):
- < 676
- 676 - 678
- 678 - 680
- 680 - 682
- 682 - 684
- 684 - 686
- 686 - 688
- 688 - 690
- > 690

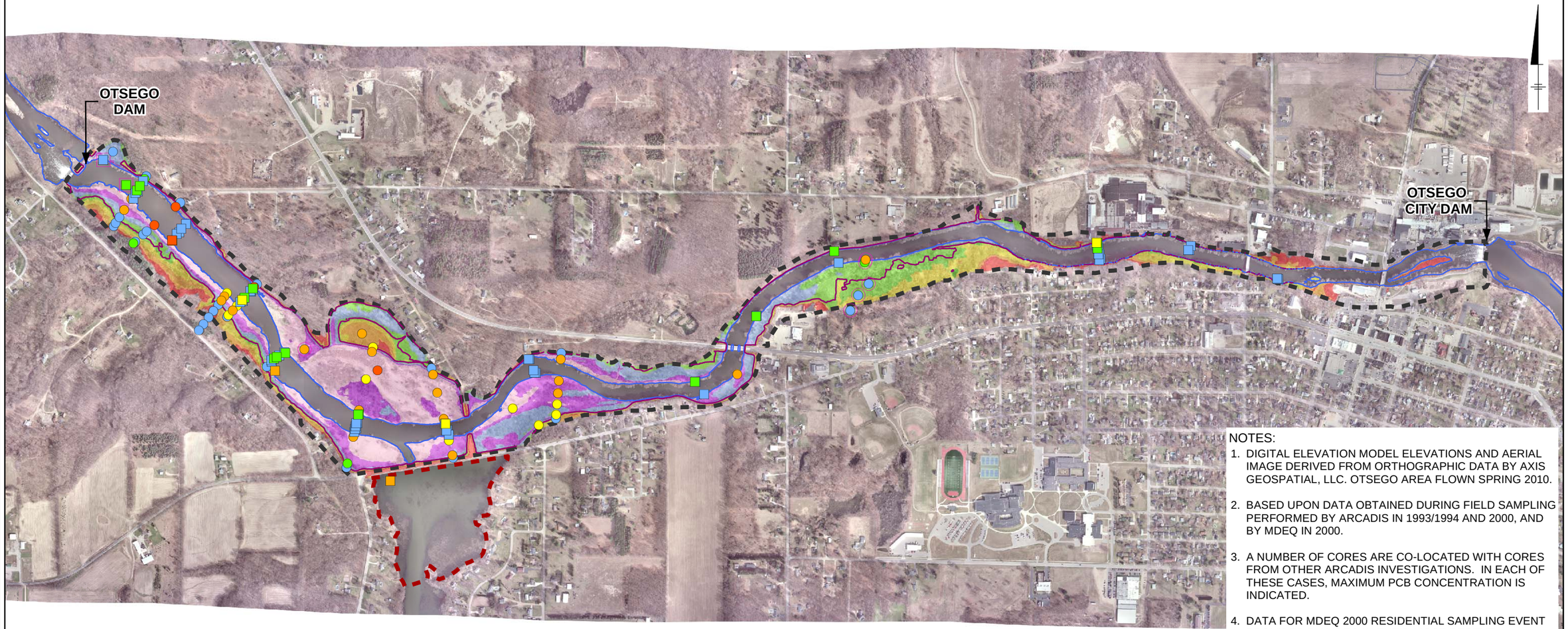
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 SURFACE PCB RESULTS

ARCADIS

FIGURE
3-2

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCityDam\ToOtsegoDam\SRIFS_WorkPlan\mxd\SRIFS_WorkPlan\mxd\Surface PCB Results - Area 3_v7.mxd 3/22/2012 4:13:55 PM



NOTES:

1. DIGITAL ELEVATION MODEL ELEVATIONS AND AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.
2. BASED UPON DATA OBTAINED DURING FIELD SAMPLING PERFORMED BY ARCADIS IN 1993/1994 AND 2000, AND BY MDEQ IN 2000.
3. A NUMBER OF CORES ARE CO-LOCATED WITH CORES FROM OTHER ARCADIS INVESTIGATIONS. IN EACH OF THESE CASES, MAXIMUM PCB CONCENTRATION IS INDICATED.
4. DATA FOR MDEQ 2000 RESIDENTIAL SAMPLING EVENT PROVIDED BY MDEQ IN THEIR MOST RECENT DATABASE SUBMITTAL ON MAY 27, 2011. FOUR SAMPLE IDS (GARD1-1, RRA-5, RRA-7, AND RRA-8) APPEAR CO-LOCATED BASED ON REPORTED SURVEY; THEREFORE, ONLY THE MAXIMUM CONCENTRATION IS SHOWN ON THIS FIGURE. DEPTH INTERVALS WERE NOT IDENTIFIED FOR FOUR SAMPLE IDS (RRA-1, RRA-5, RRA-7, AND RRA-8) AND ARE THEREFORE ASSUMED TO BE SURFACE SAMPLES.

0 1,100 2,200 Feet

GRAPHIC SCALE

LEGEND:

MAXIMUM SEDIMENT PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SEDIMENT SAMPLE LOCATION

MAXIMUM SOIL PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SOIL SAMPLE LOCATION (SEE NOTE 4)

- 683 FT CONTOUR
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY
- EXISTING SHORELINE (APPROXIMATE)

TOPOGRAPHIC ELEVATIONS (FT NGVD29):
- < 676
- 676 - 678
- 678 - 680
- 680 - 682
- 682 - 684
- 684 - 686
- 686 - 688
- 688 - 690
- > 690

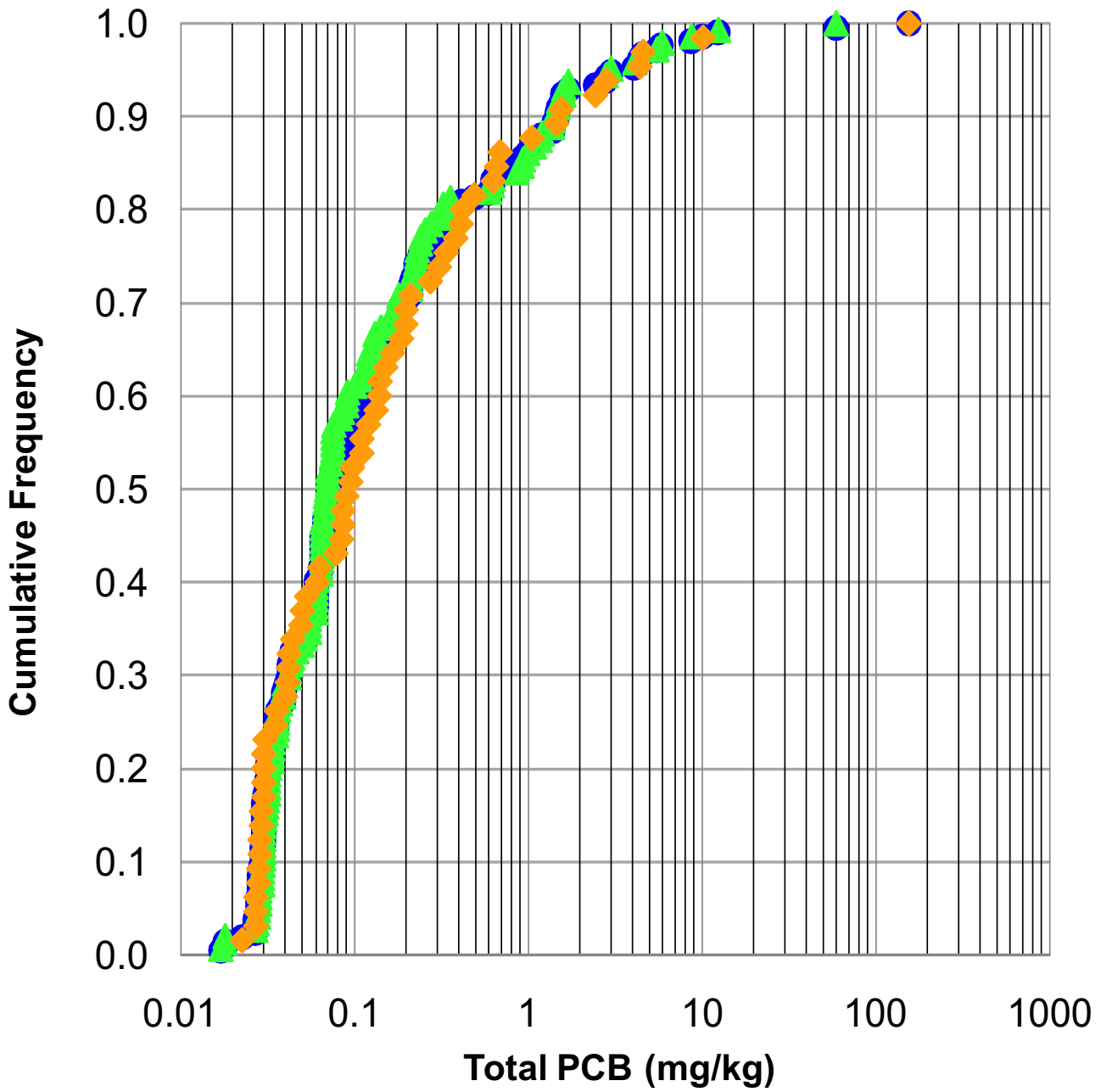
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

AREA 3 MAXIMUM PCB RESULTS

ARCADIS

FIGURE 3-3

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
K:\RSG (B0064531.0002.00500)
Q:\K\RSG\Otsego\CityDam1\OtsegoDamISRIFS_WorkPlan\mxd\Maximum PCB Results - Area 3_v6.mxd 3/22/2012 4:16:17 PM



NOTES:

1. Data includes samples collected by KRSG in 1993, 1994, and 2000.
2. Non-detects were counted as ½ the detection limit.
3. The focused sediment samples collected at location FF-66 in 2000 are excluded, as this location falls outside the primary Area 3 Impoundment.

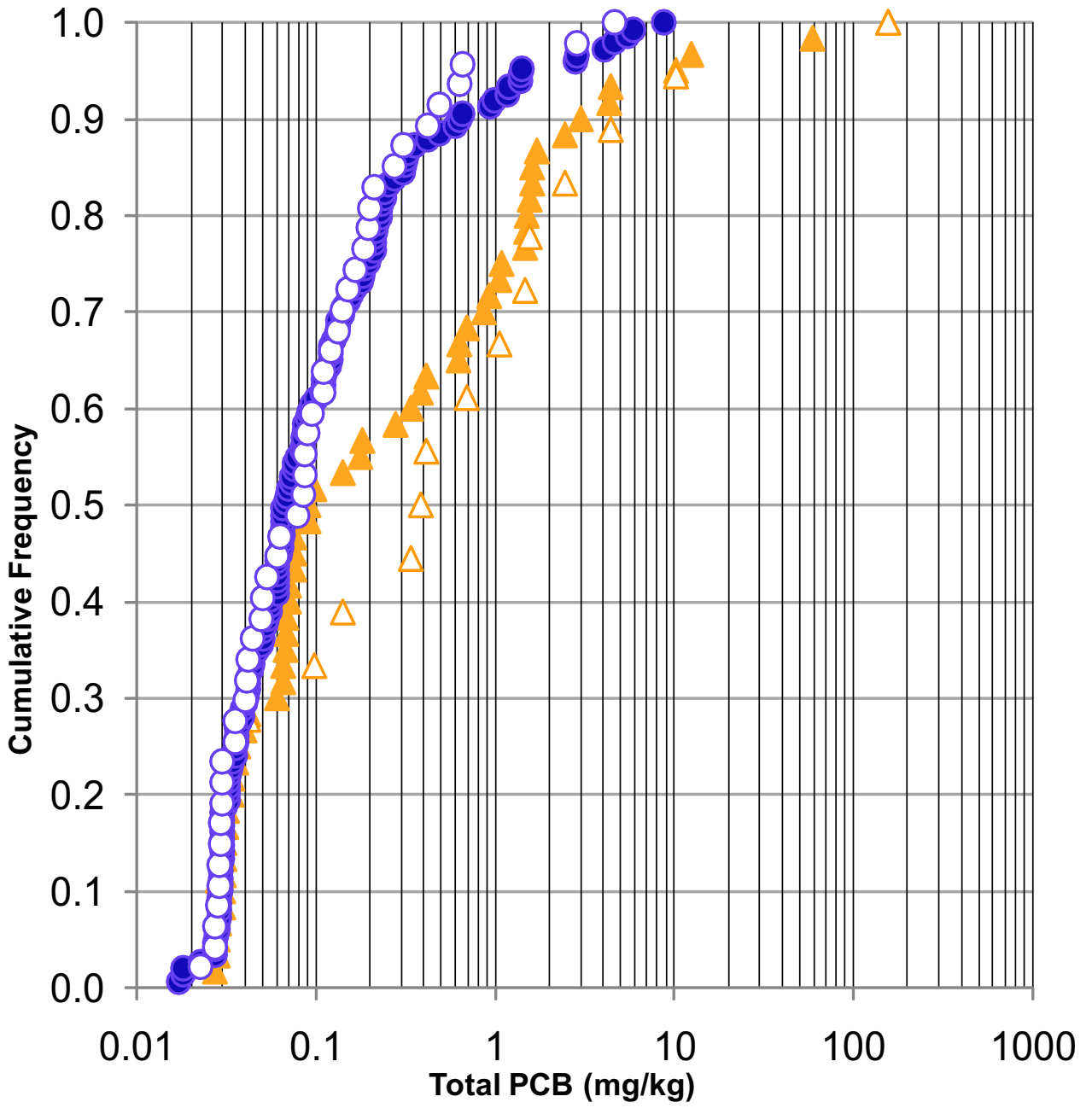
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

CUMULATIVE FREQUENCY DISTRIBUTION OF AREA 3 SEDIMENT SAMPLES

ARCADIS

FIGURE
3-4



Legend

- Fine (All Depths)
- Fine (Surface)
- Coarse (All Depths)
- Coarse (Surface)

NOTES:

1. Data includes samples collected by KRSG in 1993, 1994, and 2000.
2. Non-detects were counted as ½ the detection limit.
3. The focused sediment samples collected at location FF-66 in 2000 are excluded, as this location falls outside the primary Area 3 Impoundment.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

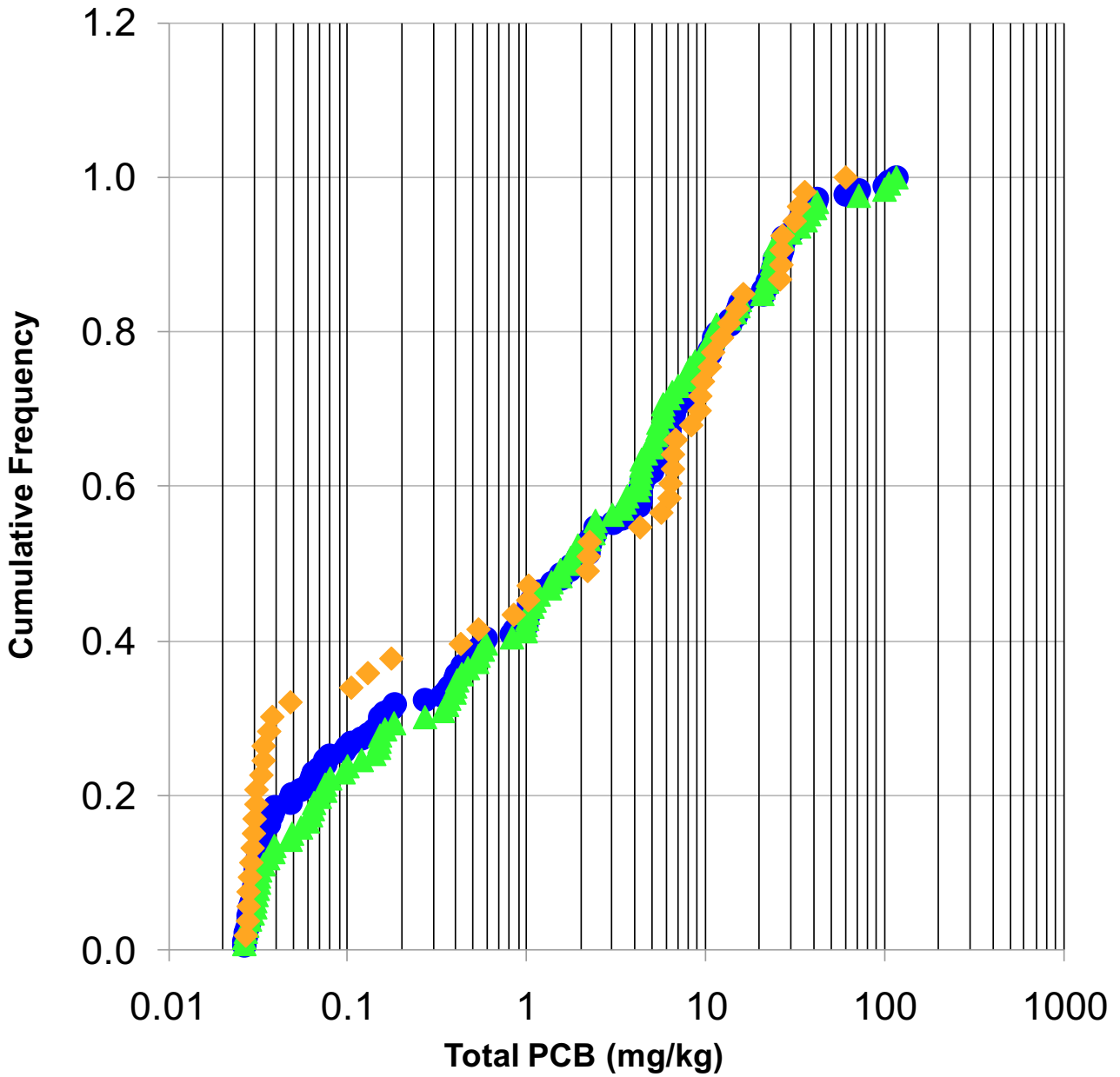
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

CUMULATIVE FREQUENCY DISTRIBUTION OF AREA 3 FINE AND COARSE SEDIMENT SAMPLES

ARCADIS

FIGURE
3-5

03/22/2012 SYRACUSE, NY-ENV/CAD DJHOWES
B0064531/0003/00500/CDR/AREA3/64531G04.CDR



Legend

- All Depths
- Subsurface
- Surface

NOTES:

1. Data includes samples collected by KRSG in 1993, 1994, and 2000.
2. Non-detects were counted as ½ the detection limit.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

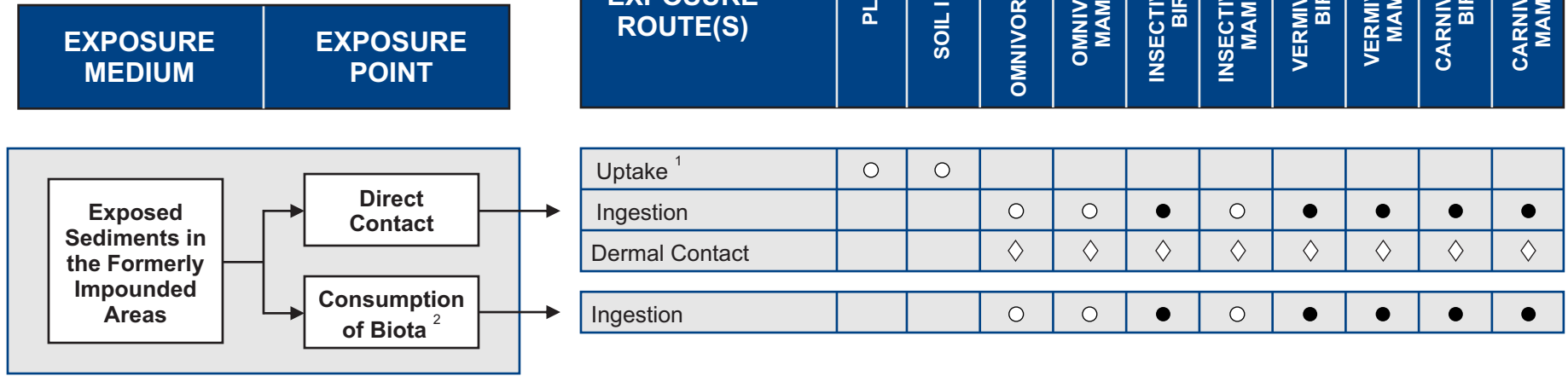
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

CUMULATIVE FREQUENCY DISTRIBUTION OF AREA 3 SOIL SAMPLES

ARCADIS

FIGURE
3-6

03/23/2012 SYRACUSE, NY-ENV/CAD DJHOWES
B0064531/0003/00500/CDR/64531G05.CDR



LEGEND

- ● = Potentially complete exposure pathway
- ◊ = Potentially complete exposure pathway, expected to be minor - not quantitatively evaluated
- ○ = Potentially complete pathway but will not be quantitatively evaluated because exposure expected to be minimal compared to other pathways being evaluated or no toxicity expected based on Site-Wide BERA (CDM 2003a)

NOTE:

[1] Uptake is defined as all exposure routes (i.e., absorption, ingestion and inhalation)

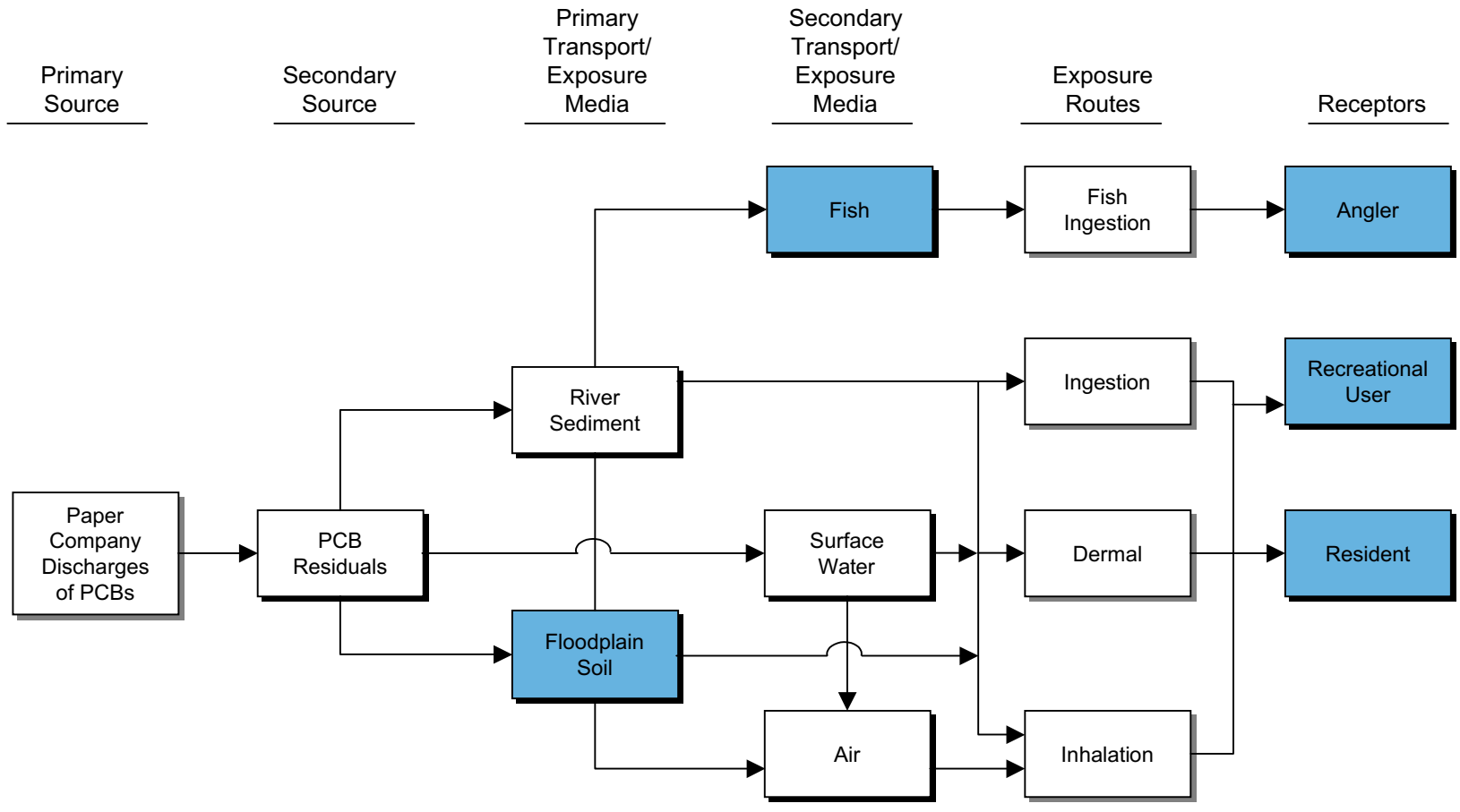
[2] Contaminated biota may include plants, invertebrates, small mammals, reptiles, amphibians and birds.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

PRELIMINARY ECOLOGICAL CONCEPTUAL SITE MODEL FOR TERRESTRIAL HABITAT

ARCADIS

FIGURE 4-9



NOTE:

CDM. 2003. *Final (Revised) Baseline Human Health Risk Assessment – Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site*. Prepared on behalf of the MDEQ Remediation and Redevelopment Division. May 2003.

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3 FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

CDM's HUMAN HEALTH CONCEPTUAL SITE MODEL

ARCADIS

FIGURE
4-10

OTSEGO DAM
T1
T2
T3
T4
T5
T6
T7
T8
PC01
PC02
PC03
PC04
PC05
PC06
PC07
PC08
PC09
FOX MOUNTAIN DR
106TH AVE
HARTER DR
RIVER RD
OLD ALLEGAN/OTSEGO RD
19TH ST
LINCOLN RD
JEFFERSON RD
MORTER RD
EARL ST
AMES AVE
WALDEN DR
21ST ST
THOREAU CT
18TH ST
MATCHLINE

NOTE:
1. DIGITAL ELEVATION MODEL ELEVATIONS AND AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.

0 700 1,400 Feet
GRAPHIC SCALE

LEGEND:

MAXIMUM SEDIMENT PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SEDIMENT SAMPLE LOCATION

MAXIMUM SOIL PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SOIL SAMPLE LOCATION

- CURRENT SHORELINE (2011)
- HISTORIC SHORELINE (1999/2000)
- HISTORIC SHORELINE (1974)
- HISTORIC SHORELINE (1967)
- HISTORIC SHORELINE (1960)
- HISTORIC SHORELINE (1955)
- HISTORIC SHORELINE (1950)
- HISTORIC SHORELINE (1938)

- 100 YEAR FEMA FLOODPLAIN
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY
- PREVIOUS CHANNEL
- TERRACE

TOPOGRAPHIC ELEVATIONS (FT NGVD29):
- < 676
- 676 - 678
- 678 - 680
- 680 - 682
- 682 - 684
- 684 - 686
- 686 - 688
- 688 - 690
- > 690

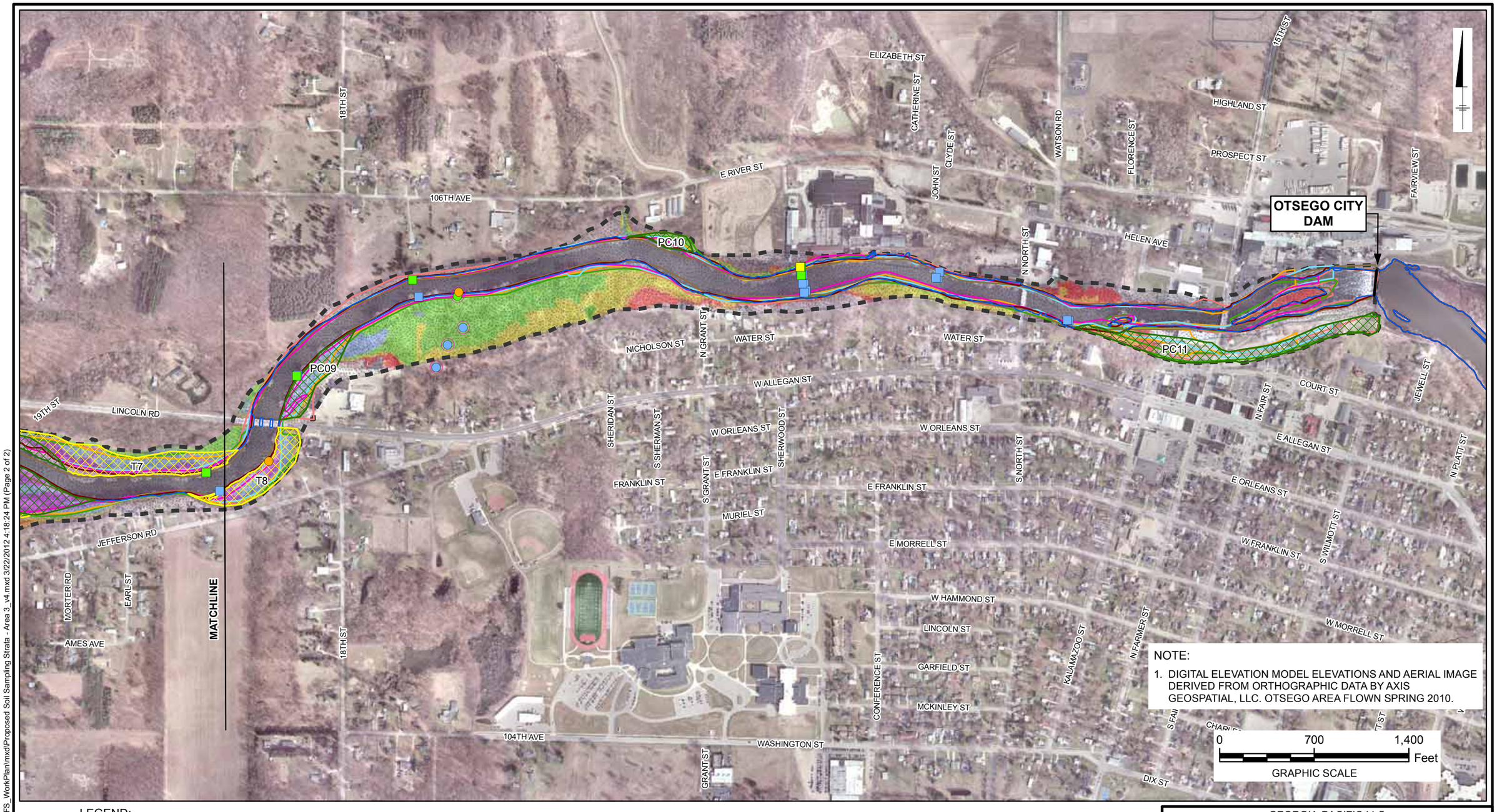
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

PRELIMINARY SOIL SAMPLING STRATA

ARCADIS

FIGURE 5-1a

City: SYR Div/Group: 90 Created By: Srut Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCityDam\OtsegoDam\SRIFS_WorkPlan\mxd\Proposed Soil Sampling Strata - Area 3_v4.mxd 3/22/2012 4:18:24 PM (Page 1 of 2)



NOTE:

1. DIGITAL ELEVATION MODEL ELEVATIONS AND AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN SPRING 2010.

0 700 1,400 Feet

GRAPHIC SCALE

LEGEND:

MAXIMUM SEDIMENT PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SEDIMENT SAMPLE LOCATION

MAXIMUM SOIL PCB RESULTS (MG/KG):
- ND - 1
- 1 - 5
- 5 - 10
- 10 - 50
- > 50
- MDEQ SOIL SAMPLE LOCATION

- CURRENT SHORELINE (2011)
- HISTORIC SHORELINE (1999/2000)
- HISTORIC SHORELINE (1974)
- HISTORIC SHORELINE (1967)
- HISTORIC SHORELINE (1960)
- HISTORIC SHORELINE (1955)
- HISTORIC SHORELINE (1950)
- HISTORIC SHORELINE (1938)

- 100 YEAR FEMA FLOODPLAIN
- APPROXIMATE AREA 3 STUDY AREA BOUNDARY
- APPROXIMATE PINE CREEK STUDY AREA BOUNDARY
- PREVIOUS CHANNEL
- TERRACE

TOPOGRAPHIC ELEVATIONS (FT NGVD29):
- < 676
- 676 - 678
- 678 - 680
- 680 - 682
- 682 - 684
- 684 - 686
- 686 - 688
- 688 - 690
- > 690

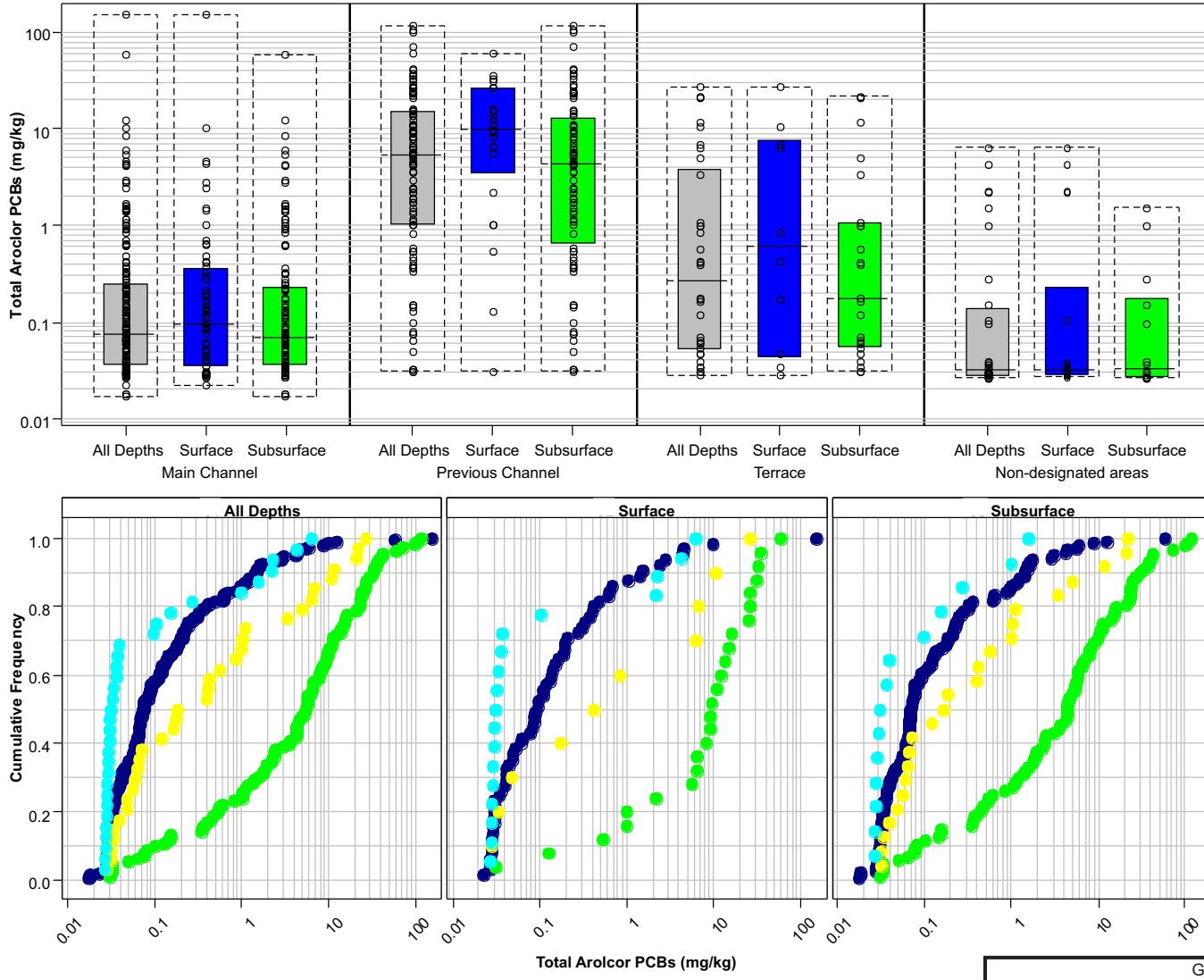
GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

PRELIMINARY SOIL SAMPLING STRATA

ARCADIS

FIGURE 5-1b

City: SYR Div/Group: 90 Created By: Sruti Pulugurtha Last Saved By: MKOHBERGER
KRSG (B0064531.0002.00500)
Q:\KRSG\OtsegoCity\DamToOtsegoDam\SRIFS_WorkPlan\mxd\Proposed Soil Sampling Strata - Area 3_v4.mxd 3/22/2012 4:18:24 PM (Page 2 of 2)



Legend for Box Plots

- All Depths
- Surface
- Subsurface

Legend for Cumulative Frequency Distributions

- Main Channel
- Previous Channel
- Terrace
- Non-Designated Areas

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SUPPLEMENTAL REMEDIAL INVESTIGATION/FEASIBILITY STUDY WORK PLAN

BOX PLOTS AND CUMULATIVE FREQUENCY DISTRIBUTIONS FOR PRELIMINARY GEOMORPHIC AREAS

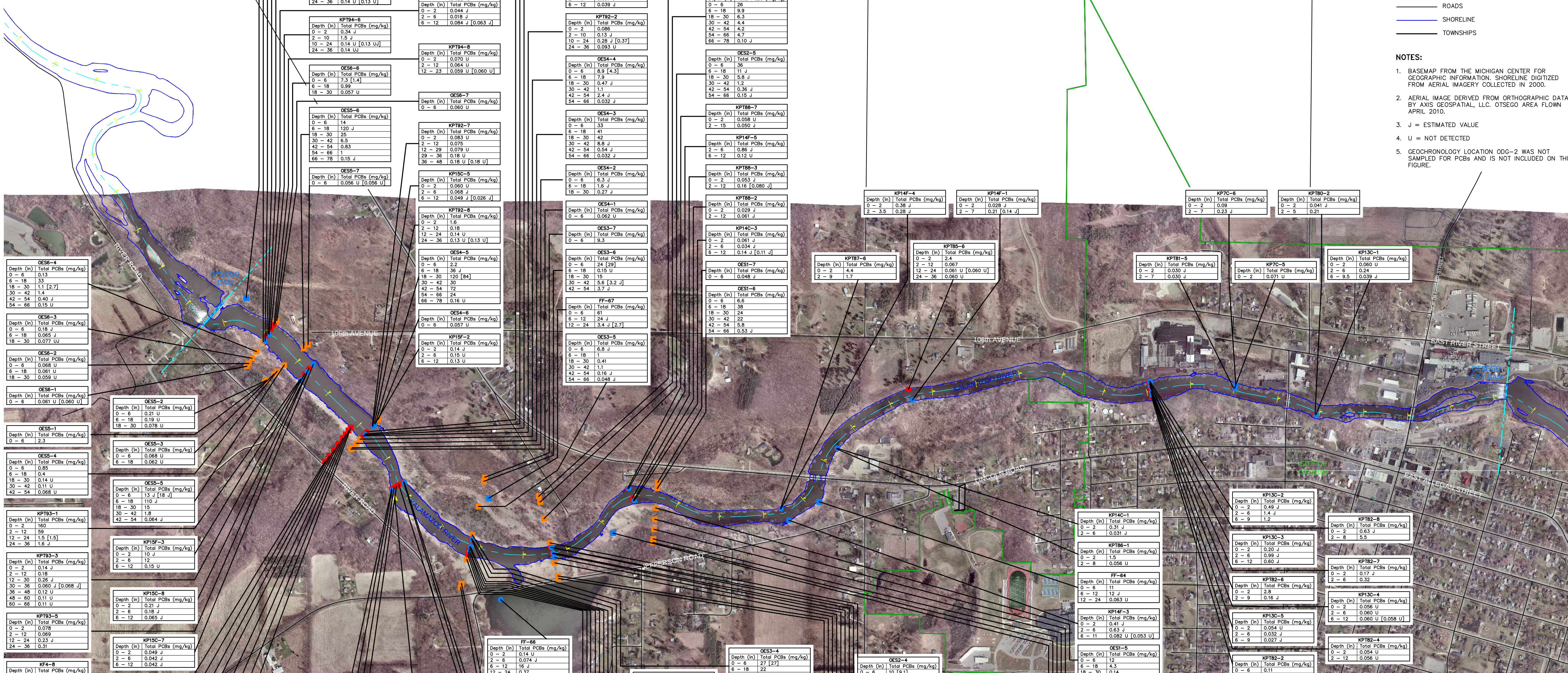
ARCADIS

FIGURE
5-2

ARCADIS

Appendix A

Data Box Maps of Available Soil and Sediment PCB Data



FF-68

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.43
6 – 12	0.12
12 – 24	0.12 U [0.13 U]

KP15C-10

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.15 J
2 – 6	0.059 U
6 – 12	0.059 U

KPT94-4

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.061 U
2 – 12	1.1
12 – 24	1.6
24 – 36	0.14 U [0.13 U]

KPT94-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.34 J
2 – 10	1.5 J
10 – 24	0.14 U [0.13 UJ]
24 – 36	0.14 UJ

OES6-6

Depth (in)	Total PCBs (mg/kg)
0 – 6	7.3 [1.4]
6 – 18	0.99
18 – 30	0.057 U

OES5-6

Depth (in)	Total PCBs (mg/kg)
0 – 6	14
6 – 18	120 J
18 – 30	25
30 – 42	6.5
42 – 54	0.83
54 – 66	1
66 – 78	0.15 J

OES5-7

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.056 U [0.056 U]

OES6-5

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.54 J
6 – 18	8.2
18 – 30	21 J
30 – 42	11
42 – 54	1.9 J
54 – 66	1.6 J
66 –78	0.44 J

KPT94-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.040 J
2 – 14	0.13
14 – 24	0.065 J
24 – 36	0.12 U

KP15C-9

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.044 J
2 – 6	0.018 J
6 – 12	0.084 J [0.063 J]

KPT94-8

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.070 U
2 – 12	0.064 U
12 – 23	0.059 U [0.060 U]

OES6-7

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.060 U

KPT92-7

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.083 U
2 – 12	0.075
12 – 29	0.079 U
29 – 36	0.18 U
36 – 48	0.18 U [0.18 U]

KP15C-5

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.060 U
2 – 6	0.068 J
6 – 12	0.049 J [0.026 J]

KPT92-8

Depth (in)	Total PCBs (mg/kg)
0 – 2	1.6
2 – 12	0.18
12 – 24	0.14 U
24 – 36	0.13 U [0.13 U]

OES4-5

Depth (in)	Total PCBs (mg/kg)
0 – 6	2.2
6 – 18	36 J
18 – 30	120 [84]
30 – 42	30
42 – 54	72
54 – 66	24
66 – 78	0.16 U

OES4-6

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.057 U

KP15F-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.14 J
2 – 6	0.15 U
6 – 12	0.13 U

KPT92-4

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.086
2 – 18	0.036 J
18 – 34	0.11 J
34 – 42	1.4
42 – 52	0.11 U [0.073 J]
52 – 60	0.12 U

KPT92-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.057 U
2 – 14	0.057 UJ
14 – 26	0.21 J
26 – 34	5.9
34 – 48	0.083 J
48 – 54	0.12 UJ

KP15C-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.13 J
2 – 6	0.091 J
6 – 12	0.039 J

KPT92-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.086
2 – 10	0.13 J
10 – 24	0.28 J [0.37]
24 – 36	0.093 U

OES4-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	8.9 [4.3]
6 – 18	7.9
18 – 30	0.47 J
30 – 42	1.1
42 – 54	2.4 J
54 – 66	0.032 J

OES4-3

Depth (in)	Total PCBs (mg/kg)
0 – 6	33
6 – 18	41
18 – 30	42
30 – 42	8.8 J
42 – 54	0.54 J
54 – 66	0.032 J

OES4-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	6.3 J
6 – 18	1.6 J
18 – 30	0.27 J

OES4-1

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.062 U

OES3-7

Depth (in)	Total PCBs (mg/kg)
0 – 6	9.3

OES3-6

Depth (in)	Total PCBs (mg/kg)
0 – 6	24 [29]
6 – 18	0.15 U
18 – 30	15
30 – 42	5.6 [3.2 J]
42 – 54	3.7 J

FF-67

Depth (in)	Total PCBs (mg/kg)
0 – 6	61
6 – 12	24 J
12 – 24	3.4 J [2.7]

OES3-5

Depth (in)	Total PCBs (mg/kg)
0 – 6	6.8 J
6 – 18	1
18 – 30	0.41
30 – 42	1.1
42 – 54	0.16 J
54 – 66	0.048 J

OES2-7

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.062 U

OES2-6

Depth (in)	Total PCBs (mg/kg)
0 – 6	26
6 – 18	9.9
18 – 30	6.3
30 – 42	4.4
42 – 54	4.2
54 – 66	4.7
66 – 78	0.10 J

OES2-5

Depth (in)	Total PCBs (mg/kg)
0 – 6	36
6 – 18	11 J
18 – 30	5.8 J
30 – 42	1.2
42 – 54	0.36 J
54 – 66	0.15 J

KPT88-7

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.058 U
2 – 15	0.050 J

KP14F-5

Depth (in)	Total PCBs (mg/kg)
2 – 6	0.86 J
6 – 12	0.12 U

KPT88-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.053 J
2 – 12	0.16 [0.080 J]

KPT88-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.029 J
2 – 12	0.061 J

KP14C-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.061 J
2 – 6	0.034 J
6 – 12	0.14 J [0.11 J]

OES1-7

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.048 J

OES1-6

Depth (in)	Total PCBs (mg/kg)
0 – 6	6.6
6 – 18	38
18 – 30	24
30 – 42	22
42 – 54	5.8
54 – 66	0.53 J

KP14F-4

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.38 J
2 – 3.5	0.28 J

KP14F-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.028 J
2 – 7	0.21 [0.14 J]

KPT87-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	4.4
2 – 9	1.7

KPT85-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	2.4
2 – 12	0.067
12 – 24	0.061 U [0.060 U]
24 – 36	0.060 U

KP7C-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.09
2 – 7	0.23 J

KPT80-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.041 J
2 – 5	0.21

KPT81-5

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.030 J
2 – 7	0.030 J

KP7C-5

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.071 U

KP13C-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.060 U
2 – 6	0.24
6 – 9.5	0.039 J

OES6-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.13
6 – 18	33
18 – 30	1.1 [2.7]
30 – 42	1.4
42 – 54	0.40 J
54 – 66	0.15 U

OES6-3

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.18 J
6 – 18	0.065 J
18 – 30	0.077 UJ

OES6-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.068 U
6 – 18	0.061 U
18 – 30	0.059 U

OES6-1

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.061 U [0.060 U]

OES5-1

Depth (in)	Total PCBs (mg/kg)
0 – 6	2.3

OES5-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.85
6 – 18	0.4
18 – 30	0.14 U
30 – 42	0.11 U
42 – 54	0.068 U

KPT93-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	160
2 – 12	59
12 – 24	1.5 [1.5]
24 – 36	1.6 J

KPT93-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.14 J
2 – 12	0.18
12 – 30	0.26 J
30 – 36	0.060 J [0.068 J]
36 – 48	0.12 U
48 – 60	0.11 U
60 – 66	0.11 U

KPT93-5

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.078
2 – 12	0.069
12 – 24	0.23 J
24 – 36	0.31

KF4-8

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.054 U
6 – 12	0.053 U

KF4-6

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.055 U [0.056 U]
6 – 12	0.055 U

OES5-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.21 U
6 – 18	0.19 U
18 – 30	0.078 U

OES5-3

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.068 U
6 – 18	0.062 U

OES5-5

Depth (in)	Total PCBs (mg/kg)
0 – 6	13 J [18 J]
6 – 18	110 J
18 – 30	15
30 – 42	1.8
42 – 54	0.064 J

KP15F-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	10 J
2 – 6	12
6 – 12	0.15 U

KP15C-8

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.21 J
2 – 6	0.18 J
6 – 12	0.065 J

KP15C-7

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.049 J
2 – 6	0.042 J
6 – 12	0.042 J

KF4-7

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.056 U
6 – 12	0.054 U

KF4-5

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.038 J
6 – 12	0.053 U

KF4-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.073 U
6 – 12	0.072 U

KF4-3

Depth (in)	Total PCBs (mg/kg)
0 – 6	11 J

KF4-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	1.0
6 – 12	14 J
12 – 24	11 J

KF4-1

Depth (in)	Total PCBs (mg/kg)
0 – 6	1.0 J
6 – 12	5.5 J
12 – 24	7.4 J [3.4 J]

KPT91-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.097 J
2 – 12	0.062 U [0.063 U]
12 – 24	0.061 U

KP15C-4

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.42 J
2 – 6	0.052 J
6 – 12	0.14 J [0.12 U]

KPT91-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.057 U
2 – 12	0.073
12 – 24	0.055 U
24 – 36	1.4
36 – 48	1.3 [0.53]
48 – 60	1.2
60 – 69	0.13 U

KPT91-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.063
2 – 12	0.076
12 – 24	0.14
24 – 36	3.3 [2.3]
36 – 48	0.14 U
48 – 51	0.17 U

ODG-1

Depth (in)	Total PCBs (mg/kg)
0 – 0.4	2.2 J
0.4 – 0.8	2.2
0.8 – 1.2	2.5
1.2 – 1.6	1.8
1.6 – 2	1.9
2 – 2.4	1.1 J
2.4 – 2.8	0.87
2.8 – 3.1	0.93
3.1 – 3.5	2.1
3.5 – 3.9	1.1 J
3.9 – 4.7	0.80
4.7 – 5.5	8.9
5.5 – 6.3	12
6.3 – 7.1	5.6
7.1 – 7.9	2.7 J
7.9 – 9.8	1.3 J
11.8 – 13.8	0.18 J [0.22 J]
13.8 – 15.7	0.17 J
15.7 – 17.7	0.19 J
17.7 – 19.7	0.13 J [0.16 J]
19.7 – 21.7	0.13 U
21.7 – 23.6	0.12 UJ
23.6 – 25.6	0.14 UJ [0.14 UJ]
25.6 – 27.6	0.13 U

FF-66

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.14 U
2 – 6	0.074 J
6 – 12	16 J
12 – 24	0.37
24 – 30	0.072 U
30 – 34	0.064 U

OES3-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	2.2
6 – 18	0.15 J

OES3-1

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.059 U

KP15C-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	4.6 J
2 – 6	0.067 U
6 – 12	0.087 U

KPT91-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.060 U
2 – 12	0.063 U
12 – 24	0.071 U
24 – 36	0.073 U

KPT91-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.050 J
6 – 18	0.057 [0.16]
18 – 30	0.36
30 – 42	0.12
42 – 54	0.088 U
54 – 61.2	0.11 U

KP15F-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.69
2 – 6	0.92
6 – 12	4.3

KP15C-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.19 J
2 – 6	0.075 J
6 – 12	0.084 J [0.16]

KPT90-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.095 J
2 – 12	0.065 J

KPT90-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.11
2 – 12	0.22

OES3-3

Depth (in)	Total PCBs (mg/kg)
0 – 6	24 [30]
6 – 18	9.6
18 – 30	16
30 – 42	5
42 – 54	3.6

OES3-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	27 [27]
6 – 18	22
18 – 30	21
30 – 42	0.99

KPT90-7

Depth (in)	Total PCBs (mg/kg)
0 – 2	1.1
2 – 12	2.9 [3.1]
12 – 21	0.62

KPT90-4

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.084 J
2 – 12	0.065
12 – 24	0.065 U
24 – 36	0.060 U

KP15C-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.27 J
2 – 6	0.036 J
6 – 12	0.31 J [0.17]

KPT90-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.084 U
2 – 12	0.064 U
12 – 19	0.060 U

OES2-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	10 [9.1]
6 – 18	27
18 – 30	7.1 J
30 – 42	2.4
42 – 54	4.4
54 – 66	7.9 J
66 – 78	2.4

KPT89-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.20 J
2 – 12	0.23
12 – 24	0.032 J
24 – 36	0.26 [0.16 J]
36 – 42	0.072 U

KPT89-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.12
2 – 12	0.057 U

OES2-3

Depth (in)	Total PCBs (mg/kg)
0 – 6	9.4
6 – 18	5.8
18 – 30	0.37 J

OES2-1

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.066 U

KP14C-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.66 J
2 – 6	4.1
6 – 12	8.7

KP14C-5

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.023 J
2 – 6	0.017 J
6 – 12	0.018 J

KP14F-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.054 U
2 – 6	0.057 U
6 – 9	0.067 U

OES2-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	15 J [17 J]
6 – 18	4.3
18 – 30	1.7
30 – 42	0.34 J
42 – 54	0.061 U

KP14C-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.31 J
2 – 6	0.031 J

KPT86-1

Depth (in)	Total PCBs (mg/kg)
0 – 2	1.5
2 – 8	0.056 U

FF-64

Depth (in)	Total PCBs (mg/kg)
0 – 6	11
6 – 12	12 J
12 – 24	0.063 U

KP14F-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.41 J
2 – 6	0.63 J
6 – 11	0.082 U [0.053 U]

OES1-5

Depth (in)	Total PCBs (mg/kg)
0 – 6	12
6 – 18	4.3
18 – 30	0.14

OES1-4

Depth (in)	Total PCBs (mg/kg)
0 – 6	32
6 – 18	24 J
18 – 30	2.2
30 – 42	0.59 J

OES1-3

Depth (in)	Total PCBs (mg/kg)
0 – 6	8.0 [8.7]
6 – 18	1.4
18 – 30	0.065 U

OES1-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	6.6 [6.2]
6 – 18	3.4
18 – 30	5
30 – 42	0.57 J
42 – 54	0.12 U
54 – 66	0.18 J

OES1-1

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.058 U

FF-65

Depth (in)	Total PCBs (mg/kg)
0 – 6	5.7 J
6 – 12	5.3 J
12 – 24	0.096 U [0.10 U]

KP13C-2

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.49 J
2 – 6	1.4 J
6 – 9	1.2

KP13C-3

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.20 J
2 – 6	0.99 J
6 – 12	0.60 J

KPT82-6

Depth (in)	Total PCBs (mg/kg)
0 – 2	2.8
2 – 9	0.16 J

KP13C-5

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.054 U
2 – 6	0.032 J
6 – 9	0.027 J

KPT82-2

Depth (in)	Total PCBs (mg/kg)
0 – 6	0.11

KPT82-8

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.63 J
2 – 8	5.5

KPT82-7

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.17 J
2 – 6	0.32

KP13C-4

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.056 U
2 – 6	0.060 U
6 – 12	0.060 U [0.058 U]

KPT82-4

Depth (in)	Total PCBs (mg/kg)
0 – 2	0.054 U
2 – 12	0.056 U

LEGEND:

- FLOODPLAIN SOIL 1993
- SEDIMENT 1993
- FLOODPLAIN SOIL 1994
- FLOODPLAIN SOIL 2000
- SEDIMENT 2000
- GEOCHRONOLOGICAL CORES
- CITIES
- DAMS
- ROADS
- SHORELINE
- TOWNSHIPS

NOTES:

1. BASEMAP FROM THE MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION. SHORELINE DIGITIZED FROM AERIAL IMAGERY COLLECTED IN 2000.
2. AERIAL IMAGE DERIVED FROM ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC. OTSEGO AREA FLOWN APRIL 2010.
3. J = ESTIMATED VALUE
4. U = NOT DETECTED
5. GEOCHRONOLOGY LOCATION ODG-2 WAS NOT SAMPLED FOR PCBs AND IS NOT INCLUDED ON THIS FIGURE.

0 600' 1200'
GRAPHIC SCALE

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE

OTSEGO CITY DAM TO OTSEGO DAM

ARCADIS

FIGURE
A-1

CITY: SYRACUSE, NY DIV/GROUP: 141/ENVCAD DB: L.POSENAUER LD:(Opt) PIC:(Opt) PM: M.ERICKSON TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
G:\ENVCAD\SYRACUSE\ACT\B0064531\0003\00500\DWG\AREA3DATA\64531C01.DWG LAYOUT: A-1 SAVED: 3/9/2012 1:21 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 3/9/2012 1:22 PM BY: POSENAUER, LISA

XREFS: 64531X00 64531X01 64531X10
IMAGES: A1.tif A2.tif B1.tif B2.tif C1.tif C2.tif D1.tif D2.tif E1.tif E2.tif F1.tif F2.tif G1.tif G2.tif H1.tif H2.tif I1.tif I2.tif

ARCADIS

Appendix B

Existing Non-PCB Data in Area 3

ARCADIS

Tables

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 1 Supplemental Remedial Investigation Report
Appendix B

Table B-1 -- Sediment TCL/TAL Data

Sampling Event	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	2000 USGS Sediment Sampling
Location ID	KPT92-7	KPT92-7	KPT92-7	KPT92-7	KPT92-7	USGS-2
Northing	353435.46	353435.46	353435.46	353435.46	353435.46	354868.73
Easting	12752218.65	12752218.65	12752218.65	12752218.65	12752218.65	12750608.59
Elevation	669.29	669.29	669.29	669.29	669.29	--
Rivermile	50.02	50.02	50.02	50.02	50.02	--
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K51296	K51297	K51298	K51299	K51300	USGS-2
Sample Date	7/23/1997	7/23/1997	7/23/1997	7/23/1997	7/23/1997	8/3/2000
Depth Interval (in)	0-2	2-12	12-29	29-36	36-48	18-26.4
Sample Duplicated					K51301	
Inorganics (mg/kg)						
Aluminum	1,300	1,900	1,400	16,000	16,000 [16,000]	--
Antimony	0.77 U	0.73 U	0.62 U	5.1 B	5.2 B [5.1 B]	--
Arsenic	5.3	3.5	2.1 B	20	19 [17]	12 U
Barium	21 B	22 B	15 B	360	470 [450]	730
Beryllium	0.020 U	0.020 U	0.020 U	0.47 B	0.44 B [0.43 B]	--
Cadmium	0.070 U	0.060 U	0.090 U	6.1	5.9 [5.8]	12
Calcium	40,000	55,000	32,000	16,000	20,000 [20,000]	--
Chromium	8.3	12	7.3	180	140 [140]	170
Cobalt	2.0 B	2.5 B	1.7 B	13 B	10 B [11 B]	--
Copper	2.9 B	3.7 B	2.6 B	390	420 [410]	310
Cyanide	0.71 UJ	0.64 UJ	0.62 U	1.6 UJ	1.5 UJ [1.5 UJ]	--
Iron	6,100	6,300	4,000	20,000	19,000 [19,000]	--
Lead	8.2	7.8	9.3	1,200	950 [970]	1,100
Magnesium	7,200	17,000	8,300	8,000	6,000 [6,100]	--
Manganese	260	290	180	180	250 [250]	--
Mercury	0.050 U	0.050 U	0.050 B	3.8	4.3 [5.1]	4.1
Nickel	6.1 B	8.3 B	5.0 B	25	73 [27]	--
Potassium	120 B	130 B	130 B	770 B	980 B [820 B]	--
Selenium	0.88 U	0.85 B	0.86 U	3.3	1.9 U [3.2]	12 U
Silver	0.46 U	0.44 U	0.24 U	4.8	4.8 [5.8]	3.2
Sodium	130 U	130 U	92 U	290 U	340 B [320 B]	--
Thallium	1.3 U	1.3 U	1.3 U	2.8 U	2.8 U [3.0 U]	--
Vanadium	4.5 B	6.6 B	8.4 B	22 B	18 B [19 B]	--
Zinc	26 J	26 J	21	620 J	920 J [650 J]	920
Herbicides (mg/kg)						
DALAPON	--	--	--	--	--	0.80 U
DICAMBA	--	--	--	--	--	0.030 U
PICLORAM	--	--	--	--	--	0.060 U
DINOSEB	--	--	--	--	--	0.060 U
Pentachlorophenol	--	--	--	--	--	0.020 U
Pesticides (mg/kg)						
2,4,5-TP	--	--	--	--	--	0.030 U
2,4-D	--	--	--	--	--	0.080 U
4,4'-DDD	0.0041 U	0.0038 U	0.0039 U	0.0087 U	0.0087 U [0.0087 U]	0.0011 U
4,4'-DDE	0.0041 U	0.0038 U	0.0039 U	0.0087 U	0.0087 U [0.0087 U]	0.0011 U
4,4'-DDT	0.0041 U	0.0038 U	0.0039 U	0.0061 J	0.0055 J [0.0055 J]	0.0011 U
Aldrin	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Alpha-BHC	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Beta-BHC	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 1 Supplemental Remedial Investigation Report
Appendix B

Table B-1 -- Sediment TCL/TAL Data

Sampling Event	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	2000 USGS Sediment Sampling
Location ID	KPT92-7	KPT92-7	KPT92-7	KPT92-7	KPT92-7	USGS-2
Northing	353435.46	353435.46	353435.46	353435.46	353435.46	354868.73
Easting	12752218.65	12752218.65	12752218.65	12752218.65	12752218.65	12750608.59
Elevation	669.29	669.29	669.29	669.29	669.29	--
Rivermile	50.02	50.02	50.02	50.02	50.02	--
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K51296	K51297	K51298	K51299	K51300	USGS-2
Sample Date	7/23/1997	7/23/1997	7/23/1997	7/23/1997	7/23/1997	8/3/2000
Depth Interval (in)	0-2	2-12	12-29	29-36	36-48	18-26.4
Sample Duplicated					K51301	
Pesticides - continued (mg/kg)						
Delta-BHC	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Gamma-BHC (Lindane)	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Alpha-Chlordane	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Gamma-Chlordane	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Dieldrin	0.0041 U	0.0038 U	0.0039 U	0.0087 U	0.0087 U [0.0087 U]	0.0011 U
Endosulfan I	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Endosulfan II	0.0041 U	0.0038 U	0.0039 U	0.0087 U	0.0087 U [0.0087 U]	0.0011 U
Endosulfan Sulfate	0.0041 U	0.0038 U	0.0039 U	0.0070 J	0.0088 [0.0087]	0.0011 U
Endrin	0.0041 U	0.0038 U	0.0039 U	0.0087 U	0.0087 U [0.0087 U]	0.0011 U
Endrin Aldehyde	0.0041 U	0.0038 U	0.0039 U	0.012	0.011 [0.013]	0.0011 U
Endrin Ketone	0.0041 U	0.0038 U	0.0039 U	0.0066 J	0.0087 U [0.0087 U]	--
Heptachlor	0.0021 U	0.0020 U	0.0020 U	0.0045 U	0.0045 U [0.0045 U]	0.0011 U
Heptachlor Epoxide	0.0021 U	0.0020 U	0.0020 U	0.0025 J	0.0025 JN [0.0026 J]	0.0011 U
Methoxychlor	0.021 U	0.020 U	0.020 U	0.024 JN	0.036 J [0.046]	0.0011 U
Technical Chlordane	--	--	--	--	--	0.057 U
Toxaphene	0.21 U	0.20 U	0.20 U	0.45 U	0.45 U [0.45 U]	0.11 U
Semivolatiles (mg/kg)						
2,2'-Oxybis(1-Chloropropane)	0.41 U	0.38 U	0.39 UJ	1.7 U	2.9 U [4.3 U]	--
2,4,5-Trichlorophenol	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.94 U
2,4,6-Trichlorophenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2,4-Dichlorophenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2,4-Dimethylphenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2,4-Dinitrophenol	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.94 U
2,4-Dinitrotoluene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2,6-Dinitrotoluene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2-Chloronaphthalene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2-Chlorophenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2-Methylnaphthalene	0.41 U	0.38 U	0.39 U	0.18 J	0.18 J [0.24 J]	0.94 U
2-Methylphenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2-Nitroaniline	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.94 U
2-Nitrophenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
3,3'-Dichlorobenzidine	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
3-Nitroaniline	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.94 U
4,6-Dinitro-2-methylphenol	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.94 U
4-Bromophenyl-phenylether	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
4-Chloro-3-Methylphenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
4-Chloroaniline	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
4-Chlorophenyl-phenylether	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
4-Methylphenol	0.41 U	0.38 U	0.39 U	0.30 J	3.2 [1.3 J]	0.94 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 1 Supplemental Remedial Investigation Report
Appendix B

Table B-1 -- Sediment TCL/TAL Data

Sampling Event	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	2000 USGS Sediment Sampling
Location ID	KPT92-7	KPT92-7	KPT92-7	KPT92-7	KPT92-7	USGS-2
Northing	353435.46	353435.46	353435.46	353435.46	353435.46	354868.73
Easting	12752218.65	12752218.65	12752218.65	12752218.65	12752218.65	12750608.59
Elevation	669.29	669.29	669.29	669.29	669.29	--
Rivermile	50.02	50.02	50.02	50.02	50.02	--
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K51296	K51297	K51298	K51299	K51300	USGS-2
Sample Date	7/23/1997	7/23/1997	7/23/1997	7/23/1997	7/23/1997	8/3/2000
Depth Interval (in)	0-2	2-12	12-29	29-36	36-48	18-26.4
Sample Duplicated					K51301	
Semivolatiles - continued (mg/kg)						
4-Nitroaniline	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.94 U
4-Nitrophenol	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.94 U
Acenaphthene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Acenaphthylene	0.41 U	0.38 U	0.39 U	1.7 U	0.18 J [0.24 J]	0.94 U
Aniline	--	--	--	--	--	0.94 U
Anthracene	0.41 U	0.38 U	0.39 U	0.16 J	0.40 J [0.54 J]	0.94 U
Benzo(a)anthracene	0.41 U	0.019 J	0.39 U	1.0 J	1.8 J [2.4 J]	0.94 U
Benzo(a)pyrene	0.41 U	0.38 U	0.39 U	0.77 J	1.5 J [2.0 J]	0.94 U
Benzo(b)fluoranthene	0.41 U	0.38 U	0.39 U	1.1 J	2.1 J [2.9 J]	0.94 U
Benzo(g,h,i)perylene	0.41 U	0.38 U	0.39 U	0.72 J	1.3 J [1.4 J]	0.94 U
Benzo(k)fluoranthene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 UJ [4.3 UJ]	0.94 U
Bis(2-chloroisopropyl)ether	--	--	--	--	--	0.94 U
bis(2-Chloroethoxy)methane	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
bis(2-Chloroethyl)ether	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
bis(2-Ethylhexyl)phthalate	0.41 U	0.38 U	0.034 J	1.7 U	2.9 U [4.3 U]	0.94 U
Butylbenzylphthalate	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Carbazole	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Chrysene	0.41 U	0.021 J	0.39 U	1.0 J	1.9 J [2.6 J]	0.94 U
Dibenzo(a,h)anthracene	0.41 U	0.38 U	0.39 U	0.21 J	0.41 J [0.42 J]	0.94 U
Dibenzofuran	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Diethylphthalate	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Dimethylphthalate	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Di-n-Butylphthalate	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Di-n-Octylphthalate	0.41 U	0.38 U	0.39 UJ	1.7 U	2.9 UJ [4.3 UJ]	0.94 U
Fluoranthene	0.41 U	0.040 J	0.39 U	1.1 J	2.3 J [3.1 J]	0.94 U
Fluorene	0.41 U	0.38 U	0.39 U	0.14 J	2.9 U [4.3 U]	0.94 U
Hexachlorobenzene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.0011 U
Hexachlorobutadiene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Hexachlorocyclopentadiene	0.41 U	0.38 U	0.39 U	1.7 UJ	2.9 UJ [4.3 UJ]	0.94 U
Hexachloroethane	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Indeno(1,2,3-cd)pyrene	0.41 U	0.38 U	0.39 U	0.53 J	0.83 J [1.2 J]	0.94 U
Isophorone	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Naphthalene	0.41 U	0.38 U	0.39 U	1.7 U	0.14 J [4.3 U]	0.94 U
Nitrobenzene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
N-Nitroso-di-n-propylamine	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
N-Nitrosodiphenylamine	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Parathion	--	--	--	--	--	0.94 U
Pentachlorophenol	1.0 U	0.96 U	0.98 U	4.4 U	7.3 U [11 U]	0.020 U
Phenanthrene	0.41 U	0.022 J	0.39 U	0.94 J	1.4 J [1.8 J]	0.94 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 1 Supplemental Remedial Investigation Report
Appendix B

Table B-1 -- Sediment TCL/TAL Data

Sampling Event	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	2000 USGS Sediment Sampling
Location ID	KPT92-7	KPT92-7	KPT92-7	KPT92-7	KPT92-7	USGS-2
Northing	353435.46	353435.46	353435.46	353435.46	353435.46	354868.73
Easting	12752218.65	12752218.65	12752218.65	12752218.65	12752218.65	12750608.59
Elevation	669.29	669.29	669.29	669.29	669.29	--
Rivermile	50.02	50.02	50.02	50.02	50.02	--
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K51296	K51297	K51298	K51299	K51300	USGS-2
Sample Date	7/23/1997	7/23/1997	7/23/1997	7/23/1997	7/23/1997	8/3/2000
Depth Interval (in)	0-2	2-12	12-29	29-36	36-48	18-26.4
Sample Duplicated					K51301	
Semivolatiles - continued (mg/kg)						
Phenol	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
Pyrene	0.020 J	0.040 J	0.39 U	2.8	4.4 [6.0]	1.4
Volatiles (mg/kg)						
1,1,1,2-Tetrachloroethane	--	--	--	--	--	1.5 U
1,1,1-Trichloroethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
1,1,2,2-Tetrachloroethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
1,1,2-Trichloroethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
1,1-Dichloroethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
1,1-Dichloroethene	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
1,1-Dichloropropene	--	--	--	--	--	1.5 U
1,2,3-Trichlorobenzene	--	--	--	--	--	1.5 U
1,2,3-Trichloropropane	--	--	--	--	--	1.5 U
1,2,4-Trichlorobenzene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
1,2,4-Trimethylbenzene	--	--	--	--	--	1.5 U
1,2-Dibromo-3-chloropropane	--	--	--	--	--	1.5 U
1,2-Dibromoethane	--	--	--	--	--	1.5 U
1,2-Dichlorobenzene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
1,2-Dichloroethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
1,2-Dichloroethene (total)	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	--
1,2-Dichloropropane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
1,3,5-Trimethylbenzene	--	--	--	--	--	1.5 U
1,3-Dichlorobenzene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
1,3-Dichloropropane	--	--	--	--	--	1.5 U
1,4-Dichlorobenzene	0.41 U	0.38 U	0.39 U	1.7 U	2.9 U [4.3 U]	0.94 U
2,2-Dichloropropane	--	--	--	--	--	1.5 U
2-Butanone	0.012 U	0.012 U	0.012 U	0.26	0.66 DJ [0.54 DJ]	2.9 U
2-Chloroethylvinyl ether	--	--	--	--	--	1.5 U
2-Chlorotoluene	--	--	--	--	--	1.5 U
2-Hexanone	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 UJ]	2.9 U
4-Chlorotoluene	--	--	--	--	--	1.5 U
4-Isopropyltoluene	--	--	--	--	--	1.5 U
4-Methyl-2-pentanone	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	2.9 U
Acetone	0.0090 J	0.024	0.012 U	0.81	2.0 DJ [1.9 D]	2.9 U
Benzene	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Bromobenzene	--	--	--	--	--	1.5 U
Bromochloromethane	--	--	--	--	--	1.5 U
Bromodichloromethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Bromoform	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Bromomethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	2.9 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 1 Supplemental Remedial Investigation Report
Appendix B

Table B-1 -- Sediment TCL/TAL Data

Sampling Event	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	1993/1994 Sediment Investigation	2000 USGS Sediment Sampling
Location ID	KPT92-7	KPT92-7	KPT92-7	KPT92-7	KPT92-7	USGS-2
Northing	353435.46	353435.46	353435.46	353435.46	353435.46	354868.73
Easting	12752218.65	12752218.65	12752218.65	12752218.65	12752218.65	12750608.59
Elevation	669.29	669.29	669.29	669.29	669.29	--
Rivermile	50.02	50.02	50.02	50.02	50.02	--
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K51296	K51297	K51298	K51299	K51300	USGS-2
Sample Date	7/23/1997	7/23/1997	7/23/1997	7/23/1997	7/23/1997	8/3/2000
Depth Interval (in)	0-2	2-12	12-29	29-36	36-48	18-26.4
Sample Duplicated					K51301	
Volatiles - continued (mg/kg)						
Carbon Disulfide	0.012 U	0.012 U	0.012 U	0.018 J	0.0090 J [0.010 J]	1.5 U
Carbon Tetrachloride	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Chlorobenzene	0.012 U	0.012 U	0.012 U	0.13 U	0.0040 J [0.0030 J]	1.5 U
Chloroethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	2.9 U
Chloroform	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Chloromethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	2.9 U
cis-1,2-Dichloroethene	--	--	--	--	--	1.5 U
cis-1,3-Dichloropropene	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Dibromochloromethane	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Dibromomethane	--	--	--	--	--	1.5 U
Dichlorodifluoromethane	--	--	--	--	--	2.9 U
Ethylbenzene	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Isopropylbenzene	--	--	--	--	--	1.5 U
m,p-Xylene	--	--	--	--	--	1.5 U
Methylene Chloride	0.010 J	0.012 U	0.0070 J	0.25	0.27 [0.18]	1.5 U
n-Butylbenzene	--	--	--	--	--	1.5 U
n-Propylbenzene	--	--	--	--	--	1.5 U
o-Xylene	--	--	--	--	--	1.5 U
sec-Butylbenzene	--	--	--	--	--	1.5 U
Styrene	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
tert-Butylbenzene	--	--	--	--	--	1.5 U
Tetrachloroethene	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Toluene	0.012 U	0.012 U	0.012 U	0.012 J	0.0080 J [0.0040 J]	1.5 U
trans-1,2-Dichloroethene	--	--	--	--	--	1.5 U
trans-1,3-Dichloropropene	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	1.5 U
Trichloroethene	0.0040 J	0.012 U	0.012 U	0.014 J	0.011 J [0.0090 J]	1.5 U
Trichlorofluoromethane	--	--	--	--	--	2.9 U
Vinyl Acetate	--	--	--	--	--	2.9 U
Vinyl Chloride	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	2.9 U
Xylenes (total)	0.012 U	0.012 U	0.012 U	0.13 U	0.026 U [0.026 U]	--

Notes:
NA -- Not applicable.
ND -- Not detected
Grey shading - Grey shading indicates the presence of a non-detect result.
mg/kg - milligrams per kilogram
Duplicate sample results presented in brackets.

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-2 -- Floodplain Soil TCL/TAL Data

Sampling Event	1993 Floodplain Investigation	1993 Floodplain Investigation	1993/1994 Former Impoundment Sediment Investigation	1993/1994 Former Impoundment Sediment Investigation
Location ID	KF4-4	KF4-4	OES6-5	OES6-5
Northing	353287.84	353287.84	354441.11	354441.11
Easting	12751866.38	12751866.38	12750917.18	12750917.18
Elevation	686.40	686.40	675.97	675.97
Rivermile	49.99	49.99	49.71	49.71
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K10042	K10043	K25320	K25321
Sample Date	7/8/1993	7/8/1993	2/16/1994	2/16/1994
Depth Interval (in)	0-6	6-12	0-6	6-18
Sample Duplicated				
Inorganics (mg/kg)				
Aluminum	3,600	4,600	9,600	13,000
Antimony	9.0 UJ	5.4 UJ	6.3 U	8.5 U
Arsenic	6.1 J	3.3 J	11	12
Barium	31 B	31	190	320
Beryllium	0.17 B	0.20 B	0.43 B	0.55 B
Cadmium	0.51 U	0.30 U	0.91 B	4.0
Calcium	960	870	26,000	17,000
Chromium	5.8	7.1	54	170
Cobalt	2.9 B	3.5 B	7.2 B	8.9 B
Copper	3.8 B	3.0	64	150
Cyanide	0.25 B	0.080 U	0.94 U	0.99 U
Iron	6,500	8,100	20,000	21,000
Lead	24	8.0	130 J	290 J
Magnesium	770 B	950	7,800	6,900
Manganese	300	340	1,200	800
Mercury	0.070 B	0.050 B	0.68	2.3
Nickel	4.1 B	5.0	21	36
Potassium	180 B	200 B	720 B	640 B
Selenium	0.27 UJ	0.26 UJ	0.60 B	0.73 BJW
Silver	R	R	1.2 U	1.7 U
Sodium	170 U	100 U	110 B	110 B
Thallium	0.46 U	0.45 U	0.43 U	0.49 U
Vanadium	9.7	12	21	24
Zinc	23	18	190	390

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-2 -- Floodplain Soil TCL/TAL Data

Sampling Event	1993 Floodplain Investigation	1993 Floodplain Investigation	1993/1994 Former Impoundment Sediment Investigation	1993/1994 Former Impoundment Sediment Investigation
Location ID	KF4-4	KF4-4	OES6-5	OES6-5
Northing	353287.84	353287.84	354441.11	354441.11
Easting	12751866.38	12751866.38	12750917.18	12750917.18
Elevation	686.40	686.40	675.97	675.97
Rivermile	49.99	49.99	49.71	49.71
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K10042	K10043	K25320	K25321
Sample Date	7/8/1993	7/8/1993	2/16/1994	2/16/1994
Depth Interval (in)	0-6	6-12	0-6	6-18
Sample Duplicated				
Pesticides (mg/kg)				
4,4'-DDD	0.0036 U	0.0035 U	R	0.070 U
4,4'-DDE	0.0036 U	0.0035 U	0.010	0.040 J
4,4'-DDT	0.0036 U	0.0035 U	R	0.070 U
Aldrin	0.0018 U	0.0018 U	0.0033 U	0.22
Alpha-BHC	0.0018 U	0.0018 U	0.0033 U	0.036 U
Beta-BHC	0.0018 U	0.0018 U	0.0033 U	R
Delta-BHC	0.0018 U	0.0018 U	0.0033 U	0.036 U
Gamma-BHC (Lindane)	0.0018 U	0.0018 U	0.0033 U	0.036 U
Alpha-Chlordane	0.0018 U	0.0018 U	0.0065 J	R
Gamma-Chlordane	0.0018 U	0.0018 U	0.0028 J	R
Dieldrin	0.0036 U	0.0035 U	0.0063 U	0.070 U
Endosulfan I	0.0018 U	0.0018 U	0.0033 U	0.036 U
Endosulfan II	0.0036 U	0.0035 U	0.0063 U	0.070 U
Endosulfan Sulfate	0.0036 U	0.0035 U	0.0063 U	0.070 U
Endrin	0.0036 U	0.0035 U	0.0063 U	0.070 U
Endrin Aldehyde	0.0036 U	0.0035 U	0.0063 U	0.070 U
Endrin Ketone	0.0036 U	0.0035 U	0.0063 U	0.070 U
Heptachlor	0.0018 U	0.0018 U	0.0033 U	0.036 U
Heptachlor Epoxide	0.0018 U	0.0018 U	0.0033 U	0.036 U
Methoxychlor	0.018 U	0.018 U	0.033 U	0.36 U
Toxaphene	0.18 U	0.18 U	0.33 U	3.6 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-2 -- Floodplain Soil TCL/TAL Data

Sampling Event	1993 Floodplain Investigation	1993 Floodplain Investigation	1993/1994 Former Impoundment Sediment Investigation	1993/1994 Former Impoundment Sediment Investigation
Location ID	KF4-4	KF4-4	OES6-5	OES6-5
Northing	353287.84	353287.84	354441.11	354441.11
Easting	12751866.38	12751866.38	12750917.18	12750917.18
Elevation	686.40	686.40	675.97	675.97
Rivermile	49.99	49.99	49.71	49.71
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K10042	K10043	K25320	K25321
Sample Date	7/8/1993	7/8/1993	2/16/1994	2/16/1994
Depth Interval (in)	0-6	6-12	0-6	6-18
Sample Duplicated				
Semivolatiles (mg/kg)				
2,2'-Oxybis(1-Chloropropane)	0.35 U	0.35 U	0.63 UJ	0.70 UJ
2,4,5-Trichlorophenol	0.86 U	0.85 U	1.5 U	1.7 U
2,4,6-Trichlorophenol	0.35 U	0.35 U	0.63 U	0.70 U
2,4-Dichlorophenol	0.35 U	0.35 U	0.63 U	0.70 U
2,4-Dimethylphenol	0.35 U	0.35 U	0.63 U	0.70 U
2,4-Dinitrophenol	0.86 UJ	0.85 UJ	1.5 U	1.7 U
2,4-Dinitrotoluene	0.35 U	0.35 U	0.63 U	0.70 U
2,6-Dinitrotoluene	0.35 U	0.35 U	0.63 U	0.70 U
2-Chloronaphthalene	0.35 U	0.35 U	0.63 U	0.70 U
2-Chlorophenol	0.35 U	0.35 U	0.63 U	0.70 U
2-Methylnaphthalene	0.35 U	0.35 U	0.63 U	0.70 U
2-Methylphenol	0.35 U	0.35 U	0.63 U	0.70 U
2-Nitroaniline	0.86 U	0.85 U	1.5 U	1.7 U
2-Nitrophenol	0.35 U	0.35 U	0.63 U	0.70 U
3,3'-Dichlorobenzidine	0.35 U	0.35 U	0.63 U	0.70 U
3-Nitroaniline	0.86 U	0.85 U	1.5 U	1.7 U
4,6-Dinitro-2-methylphenol	0.86 U	0.85 U	1.5 U	1.7 U
4-Bromophenyl-phenylether	0.35 U	0.35 U	0.63 U	0.70 U
4-Chloro-3-Methylphenol	0.35 U	0.35 U	0.63 U	0.70 U
4-Chloroaniline	0.35 UJ	0.35 UJ	0.63 U	0.70 U
4-Chlorophenyl-phenylether	0.35 U	0.35 U	0.63 U	0.70 U
4-Methylphenol	0.35 U	0.35 U	0.63 U	0.70 U
4-Nitroaniline	0.86 U	0.85 U	1.5 U	1.7 U
4-Nitrophenol	0.86 U	0.85 U	1.5 U	1.7 U
Acenaphthene	0.35 U	0.35 U	0.63 U	0.70 U
Acenaphthylene	0.35 U	0.35 U	0.63 U	0.70 U
Anthracene	0.35 U	0.35 U	0.63 U	0.70 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-2 -- Floodplain Soil TCL/TAL Data

Sampling Event	1993 Floodplain Investigation	1993 Floodplain Investigation	1993/1994 Former Impoundment Sediment Investigation	1993/1994 Former Impoundment Sediment Investigation
Location ID	KF4-4	KF4-4	OES6-5	OES6-5
Northing	353287.84	353287.84	354441.11	354441.11
Easting	12751866.38	12751866.38	12750917.18	12750917.18
Elevation	686.40	686.40	675.97	675.97
Rivermile	49.99	49.99	49.71	49.71
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K10042	K10043	K25320	K25321
Sample Date	7/8/1993	7/8/1993	2/16/1994	2/16/1994
Depth Interval (in)	0-6	6-12	0-6	6-18
Sample Duplicated				
Semivolatiles - continued (mg/kg)				
Benzo(a)anthracene	0.35 U	0.35 U	0.099 J	0.075 J
Benzo(a)pyrene	0.35 U	0.35 U	0.14 J	0.098 J
Benzo(b)fluoranthene	0.35 U	0.35 U	0.15 J	0.11 J
Benzo(g,h,i)perylene	0.35 U	0.35 U	0.087 J	0.092 J
Benzo(k)fluoranthene	0.35 U	0.35 U	0.14 J	0.072 J
bis(2-Chloroethoxy)methane	0.35 U	0.35 U	0.63 U	0.70 U
bis(2-Chloroethyl)ether	0.35 U	0.35 U	0.63 U	0.70 U
bis(2-Ethylhexyl)phthalate	0.35 U	0.35 U	0.066 J	0.37 J
Butylbenzylphthalate	0.35 U	0.35 U	0.63 U	0.70 U
Carbazole	0.35 U	0.35 U	0.63 U	0.70 U
Chrysene	0.35 U	0.35 U	0.15 J	0.12 J
Dibenzo(a,h)anthracene	0.35 U	0.35 U	0.63 U	0.70 U
Dibenzofuran	0.35 U	0.35 U	0.63 U	0.70 U
Diethylphthalate	0.35 U	0.35 U	0.63 U	0.70 U
Dimethylphthalate	0.35 U	0.35 U	0.63 U	0.70 U
Di-n-Butylphthalate	0.35 U	0.35 U	0.63 U	0.70 U
Di-n-Octylphthalate	0.35 U	0.35 U	0.63 UJ	0.70 UJ
Fluoranthene	0.35 U	0.35 U	0.26 J	0.14 J
Fluorene	0.35 U	0.35 U	0.63 U	0.70 U
Hexachlorobenzene	0.35 U	0.35 U	0.63 U	0.70 U
Hexachlorobutadiene	0.35 U	0.35 U	0.63 U	0.70 U
Hexachlorocyclopentadiene	0.35 U	0.35 U	0.63 U	0.70 U
Hexachloroethane	0.35 U	0.35 U	0.63 U	0.70 U
Indeno(1,2,3-cd)pyrene	0.35 U	0.35 U	0.10 J	0.086 J
Isophorone	0.35 U	0.35 U	0.63 U	0.70 U
Naphthalene	0.35 U	0.35 U	0.63 U	0.70 U
Nitrobenzene	0.35 U	0.35 U	0.63 U	0.70 U
N-Nitroso-di-n-propylamine	0.35 U	0.35 U	0.63 U	0.70 U
N-Nitrosodiphenylamine	0.35 U	0.35 U	0.63 U	0.70 U
Pentachlorophenol	0.86 U	0.85 U	1.5 U	1.7 U
Phenanthrene	0.35 U	0.35 U	0.10 J	0.062 J
Phenol	0.35 U	0.35 U	0.63 U	0.70 U
Pyrene	0.35 U	0.35 U	0.17 J	0.12 J

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-2 -- Floodplain Soil TCL/TAL Data

Sampling Event	1993 Floodplain Investigation	1993 Floodplain Investigation	1993/1994 Former Impoundment Sediment Investigation	1993/1994 Former Impoundment Sediment Investigation
Location ID	KF4-4	KF4-4	OES6-5	OES6-5
Northing	353287.84	353287.84	354441.11	354441.11
Easting	12751866.38	12751866.38	12750917.18	12750917.18
Elevation	686.40	686.40	675.97	675.97
Rivermile	49.99	49.99	49.71	49.71
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K10042	K10043	K25320	K25321
Sample Date	7/8/1993	7/8/1993	2/16/1994	2/16/1994
Depth Interval (in)	0-6	6-12	0-6	6-18
Sample Duplicated				
Volatiles (mg/kg)				
1,1,1-Trichloroethane	0.011 U	0.012 U	0.019 U	0.020 U
1,1,2,2-Tetrachloroethane	0.011 U	0.012 U	0.019 U	0.020 U
1,1,2-Trichloroethane	0.011 U	0.012 U	0.019 U	0.020 U
1,1-Dichloroethane	0.011 U	0.012 U	0.019 U	0.020 U
1,1-Dichloroethene	0.011 U	0.012 U	0.019 U	0.020 U
1,2,4-Trichlorobenzene	0.35 U	0.35 U	0.63 U	0.70 U
1,2-Dichlorobenzene	0.35 U	0.35 U	0.63 U	0.70 U
1,2-Dichloroethane	0.011 U	0.012 U	0.019 U	0.020 U
1,2-Dichloroethene (total)	0.011 U	0.012 U	0.019 U	0.020 U
1,2-Dichloropropane	0.011 U	0.012 U	0.019 U	0.020 U
1,3-Dichlorobenzene	0.35 U	0.35 U	0.63 U	0.70 U
1,4-Dichlorobenzene	0.35 U	0.35 U	0.63 U	0.70 U
2-Butanone	0.011 U	0.012 U	0.019 U	0.020 U
2-Hexanone	0.011 U	0.012 U	0.019 U	0.020 U
4-Methyl-2-pentanone	0.011 U	0.012 U	0.019 U	0.020 U
Acetone	0.011 U	0.012 UJ	0.019 U	0.020 U
Benzene	0.011 U	0.012 U	0.019 U	0.020 U
Bromodichloromethane	0.011 U	0.012 U	0.019 U	0.020 U
Bromoform	0.011 U	0.012 U	0.019 U	0.020 U
Bromomethane	0.011 U	0.012 U	0.019 UJ	0.020 UJ
Carbon Disulfide	0.011 U	0.012 U	0.019 U	0.020 U
Carbon Tetrachloride	0.011 U	0.012 U	0.019 U	0.020 U
Chlorobenzene	0.011 U	0.012 U	0.019 U	0.020 U
Chloroethane	0.011 UJ	0.012 U	0.019 U	0.020 U
Chloroform	0.011 U	0.012 U	0.019 U	0.020 U
Chloromethane	0.011 U	0.012 U	0.019 UJ	0.020 UJ
cis-1,3-Dichloropropene	0.011 U	0.012 U	0.019 U	0.020 U
Dibromochloromethane	0.011 U	0.012 U	0.019 U	0.020 U
Ethylbenzene	0.011 U	0.012 U	0.019 U	0.020 U
Methylene Chloride	0.011 U	0.012 U	0.019 U	0.020 U
Styrene	0.011 U	0.012 U	0.019 U	0.020 U
Tetrachloroethene	0.011 U	0.012 U	0.019 U	0.020 U
Toluene	0.011 U	0.0020 J	0.019 U	0.020 U
trans-1,3-Dichloropropene	0.011 U	0.012 U	0.019 U	0.020 U
Trichloroethene	0.011 U	0.012 U	0.019 U	0.020 U
Vinyl Chloride	0.011 U	0.012 U	0.019 U	0.020 U
Xylenes (total)	0.011 U	0.012 U	0.019 U	0.020 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-2 -- Floodplain Soil TCL/TAL Data

Sampling Event	1993 Floodplain Investigation	1993 Floodplain Investigation	1993/1994 Former Impoundment Sediment Investigation	1993/1994 Former Impoundment Sediment Investigation
Location ID	KF4-4	KF4-4	OES6-5	OES6-5
Northing	353287.84	353287.84	354441.11	354441.11
Easting	12751866.38	12751866.38	12750917.18	12750917.18
Elevation	686.40	686.40	675.97	675.97
Rivermile	49.99	49.99	49.71	49.71
SRI Reach	AREA 3	AREA 3	AREA 3	AREA 3
Sample ID	K10042	K10043	K25320	K25321
Sample Date	7/8/1993	7/8/1993	2/16/1994	2/16/1994
Depth Interval (in)	0-6	6-12	0-6	6-18
Sample Duplicated				

Notes:
- Grey shading indicates the presence of a non-detect result.
- Black shading indicates the presence of a rejected result.
mg/kg - milligrams per kilogram

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-3 -- Surface Water TCL/TAL Data

Sampling Event	1993/1994 Surface Water
Location ID	SWK-4
Northing	353568.88
Easting	12764635.62
SRI Reach	AREA 3
Sample ID	K34114
Sample Date	8/14/1994
Inorganics (mg/L)	
Aluminum	0.47
Antimony	0.0013 U
Arsenic	0.0023 B
Barium	0.072 B
Beryllium	0.00010 U
Cadmium	0.00020 U
Calcium	59
Chromium	0.0024 B
Cobalt	0.00075 B
Copper	0.0048 B
Cyanide	0.0062
Iron	1.3
Lead	0.0045
Magnesium	17
Manganese	0.087
Mercury	0.000060 B
Nickel	0.0029 B
Potassium	2.8 B
Selenium	0.0032 BJ
Silver	0.00064 B
Sodium	12
Thallium	0.0019 U
Vanadium	0.0022 B
Zinc	0.022

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-3 -- Surface Water TCL/TAL Data

Sampling Event	1993/1994 Surface Water
Location ID	SWK-4
Northing	353568.88
Easting	12764635.62
SRI Reach	AREA 3
Sample ID	K34114
Sample Date	8/14/1994
Pesticides (ug/L)	
4,4'-DDD	0.10 U
4,4'-DDE	0.10 U
4,4'-DDT	0.10 U
Aldrin	0.050 U
Alpha-BHC	0.050 U
Beta-BHC	0.050 U
Delta-BHC	0.050 U
Gamma-BHC (Lindane)	0.050 U
Alpha-Chlordane	0.050 U
Gamma-Chlordane	0.050 U
Dieldrin	0.10 U
Endosulfan I	0.050 U
Endosulfan II	0.10 U
Endosulfan Sulfate	0.10 U
Endrin	0.10 U
Endrin Aldehyde	0.10 U
Endrin Ketone	0.10 U
Heptachlor	0.050 U
Heptachlor Epoxide	0.050 U
Methoxychlor	0.50 U
Toxaphene	5.0 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-3 -- Surface Water TCL/TAL Data

Sampling Event	1993/1994 Surface Water
Location ID	SWK-4
Northing	353568.88
Easting	12764635.62
SRI Reach	AREA 3
Sample ID	K34114
Sample Date	8/14/1994
Semivolatiles (ug/L)	
2,2'-Oxybis(1-Chloropropane)	10 U
2,4,5-Trichlorophenol	25 U
2,4,6-Trichlorophenol	10 U
2,4-Dichlorophenol	10 U
2,4-Dimethylphenol	10 U
2,4-Dinitrophenol	25 UJ
2,4-Dinitrotoluene	10 U
2,6-Dinitrotoluene	10 U
2-Chloronaphthalene	10 U
2-Chlorophenol	10 U
2-Methylnaphthalene	10 U
2-Methylphenol	10 U
2-Nitroaniline	25 U
2-Nitrophenol	10 U
3,3'-Dichlorobenzidine	10 U
3-Nitroaniline	25 U
4,6-Dinitro-2-methylphenol	25 UJ
4-Bromophenyl-phenylether	10 U
4-Chloro-3-Methylphenol	10 U
4-Chloroaniline	10 U
4-Chlorophenyl-phenylether	10 U
4-Methylphenol	10 U
4-Nitroaniline	25 U
4-Nitrophenol	25 U
Acenaphthene	10 U
Acenaphthylene	10 U
Anthracene	10 U

Table B-3 -- Surface Water TCL/TAL Data

Sampling Event	1993/1994 Surface Water
Location ID	SWK-4
Northing	353568.88
Easting	12764635.62
SRI Reach	AREA 3
Sample ID	K34114
Sample Date	8/14/1994
Semivolatiles - continued (ug/L)	
Benzo(a)anthracene	10 U
Benzo(a)pyrene	10 U
Benzo(b)fluoranthene	10 U
Benzo(g,h,i)perylene	10 U
Benzo(k)fluoranthene	10 UJ
bis(2-Chloroethoxy)methane	10 U
bis(2-Chloroethyl)ether	10 U
bis(2-Ethylhexyl)phthalate	10 U
Butylbenzylphthalate	10 U
Carbazole	10 U
Chrysene	10 U
Dibenzo(a,h)anthracene	10 U
Dibenzofuran	10 U
Diethylphthalate	10 U
Dimethylphthalate	10 U
Di-n-Butylphthalate	10 U
Di-n-Octylphthalate	10 U
Fluoranthene	10 U
Fluorene	10 U
Hexachlorobenzene	10 U
Hexachlorobutadiene	10 U
Hexachlorocyclopentadiene	10 U
Hexachloroethane	10 U
Indeno(1,2,3-cd)pyrene	10 U
Isophorone	10 U
Naphthalene	10 U
Nitrobenzene	10 U
N-Nitroso-di-n-propylamine	10 U
N-Nitrosodiphenylamine	10 U
Pentachlorophenol	25 U
Phenanthrene	10 U
Phenol	10 U
Pyrene	10 U

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-3 -- Surface Water TCL/TAL Data

Sampling Event	1993/1994 Surface Water
Location ID	SWK-4
Northing	353568.88
Easting	12764635.62
SRI Reach	AREA 3
Sample ID	K34114
Sample Date	8/14/1994
Volatiles (ug/L)	
1,1,1-Trichloroethane	10 U
1,1,2,2-Tetrachloroethane	10 U
1,1,2-Trichloroethane	10 U
1,1-Dichloroethane	10 U
1,1-Dichloroethene	10 U
1,2,4-Trichlorobenzene	10 U
1,2-Dichlorobenzene	10 U
1,2-Dichloroethane	10 U
1,2-Dichloroethene (total)	10 U
1,2-Dichloropropane	10 U
1,3-Dichlorobenzene	10 U
1,4-Dichlorobenzene	10 U
2-Butanone	10 UJ
2-Hexanone	10 U
4-Methyl-2-pentanone	10 U
Acetone	10 U
Benzene	10 U
Bromodichloromethane	10 U
Bromoform	10 U
Bromomethane	10 U
Carbon Disulfide	10 U
Carbon Tetrachloride	10 U
Chlorobenzene	10 U
Chloroethane	10 U
Chloroform	10 U
Chloromethane	10 U
cis-1,3-Dichloropropene	10 U
Dibromochloromethane	10 U
Ethylbenzene	10 U
Methylene Chloride	10 U
Styrene	10 U
Tetrachloroethene	10 U
Toluene	10 U
trans-1,3-Dichloropropene	10 U
Trichloroethene	10 U
Vinyl Chloride	10 U
Xylenes (total)	10 U

Note:
- Grey shading indicates a non-detect result.
mg/L - milligrams per liter
ug/L - micrograms per liter

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-4 -- Fish 1993 Pesticides and Mercury Data

Sampling Event	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation
Location ID	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07
Sample ID	K40268F	K40269F	K40270F	K40271F	K40272F	K40273F	K40274F	K40275F	K40284F	K40285F	K40286F
ABSA	7	7	7	7	7	7	7	7	7	7	7
Sample Date	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993
Species	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp	Carp
Tissue	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet
Composite (Y/N)	N	N	N	N	N	N	N	N	N	N	N
Length (in)	24.4	25.2	24.0	21.7	19.3	19.7	18.5	19.3	18.9	24.8	22.8
Weight (lbs)	6.4	7.9	7.9	4.6	3.3	3.3	2.9	3.7	3.1	7.3	5.3
Inorganics (mg/kg)											
Mercury	0.10	0.090	0.13	0.080	0.060	0.030	0.050	0.030	0.050	0.060	0.12
Pesticides (mg/kg)											
4,4'-DDD	0.011	0.037	0.025 J	0.027 J	0.013 J	0.017	0.036	0.036	0.052 J	0.044	0.076
4,4'-DDE	0.031 J	0.11	0.085 J	0.059 J	0.031 J	0.039 J	0.099	0.10	0.16 J	0.096	0.17 EJ
4,4'-DDT	0.010 U	R	0.012 JN	R	0.010 UJ	0.010 U	R	R	R	R	R
Total DDT (4,4)	0.042 J	--	0.12 J	--	0.044 J	0.056 J	--	--	--	--	--
2-Bromobiphenyl	0.010 U	0.010 U	0.010 UJ	0.010 UJ	0.010 UJ	0.010 U	0.010 U	0.010 U	0.020 UJ	0.010 U	0.010 U
3-Bromobiphenyl	0.010 U	0.010 U	0.010 UJ	0.010 UJ	0.010 UJ	0.010 U	0.010 U	0.010 U	0.020 UJ	0.010 U	0.010 U
4-Bromobiphenyl	0.010 U	0.010 U	0.010 UJ	0.010 UJ	0.010 UJ	0.010 U	0.010 U	0.010 U	0.020 UJ	0.010 U	0.010 U
Aldrin	0.022 J	0.054 JN	0.014 J	0.045 J	0.028 JN	0.058 J	0.072	0.057 J	0.12 J	0.057 J	0.10 EJ
cis-Nonachlor	0.0057 J	0.021	0.0054 JN	0.0069 JN	0.0050 UJ	0.0072 JN	0.018	0.018	0.024 J	R	0.034
Dieldrin	0.010 U	R	0.010 J	0.010 UJ	R	0.010 U	R	R	R	R	R
Gamma-BHC (Lindane)	0.0050 U	0.0050 U	0.0050 UJ	0.0050 UJ	0.0050 UJ	0.0050 U	0.0050 U	0.0050 U	0.010 UJ	0.0050 U	0.0050 U
Heptachlor Epoxide	0.011	0.021 J	0.013 J	0.023 J	R	0.035	0.048	0.034	0.069 J	0.030	0.066
Hexabromobiphenyl	0.020 U	0.020 U	0.020 UJ	0.020 UJ	0.020 UJ	0.020 U	0.020 U	0.020 U	0.040 UJ	0.020 U	0.020 U
Hexachlorobenzene	0.0050 U	0.0050 U	0.0050 UJ	0.0050 UJ	0.0050 UJ	0.0050 U	0.0050 U	0.0050 U	0.010 UJ	0.0050 U	0.0050 U
Alpha-Chlordane	0.0050 U	0.0079	0.0079 J	0.0064 J	0.0050 UJ	0.0050 JN	0.0095 J	0.011	0.017 J	0.0095	0.021
Gamma-Chlordane	0.0066 JN	0.018 JN	0.0086 J	R	0.0078 JN	R	R	0.018 JN	R	0.018 JN	R
Total Alpha + Gamma Chlordane	0.0066 J	0.026 J	0.017 J	--	0.0078 J	--	--	0.029 J	--	0.028 J	--
Toxaphene	0.20 U	0.20 U	0.20 UJ	0.20 UJ	0.20 UJ	0.20 U	0.20 U	0.20 U	0.40 UJ	0.20 U	0.20 U
trans-Nonachlor	0.0050 U	R	0.010 J	R	0.0050 UJ	R	R	R	R	R	R

Notes:
- Grey shading indicates the presence of a non-detect result.
- Black shading indicates the presence of a rejected result.
mg/kg - milligrams per kilogram

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-4 -- Fish 1993 Pesticides and Mercury Data

Sampling Event	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation
Location ID	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07
Sample ID	K40276F	K40277F	K40278F	K40279F	K40280F	K40281F	K40282F	K40287F	K40288F	K40289F	K40290F
ABSA	7	7	7	7	7	7	7	7	7	7	7
Sample Date	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993
Species	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass	Smallmouth Bass
Tissue	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet	Fillet
Composite (Y/N)	N	N	N	N	N	N	N	N	N	N	N
Length (in)	13.0	13.4	15.0	14.6	17.3	16.1	15.0	15.0	12.2	11.8	14.2
Weight (lbs)	0.9	1.1	1.5	1.3	2.4	2.0	1.5	1.5	0.7	0.7	1.1
Inorganics (mg/kg)											
Mercury	0.25 JN	0.10 JN	0.27 JN	0.19 JN	0.33 JN	0.31 JN	0.13 JN	0.33 JN	0.15 JN	0.10 JN	0.22 JN
Pesticides (mg/kg)											
4,4'-DDD	0.014	0.013	0.033	0.010 U	0.036	0.023	0.025	0.010 U	0.011	0.010 U	0.010 U
4,4'-DDE	0.051	0.043 J	0.093	0.018 J	0.16	0.039	0.095	0.012	0.050	0.022 J	0.027 J
4,4'-DDT	R	R	R	0.010 U	R	R	R	0.010 U	R	0.010 U	0.010 U
Total DDT (4,4)	--	--	--	0.018 J	--	--	--	0.012	--	0.022 J	0.027 J
2-Bromobiphenyl	0.010 U	0.010 U	0.010 U	0.010 U	0.030 U	0.010 U	0.020 U	0.010 U	0.010 U	0.010 U	0.010 U
3-Bromobiphenyl	0.010 U	0.010 U	0.010 U	0.010 U	0.030 U	0.010 U	0.020 U	0.010 U	0.010 U	0.010 U	0.010 U
4-Bromobiphenyl	0.010 U	0.010 U	0.010 U	0.010 U	0.030 U	0.010 U	0.020 U	0.010 U	0.010 U	0.010 U	0.010 U
Aldrin	0.028 J	0.029 JN	0.026 J	0.011 JN	R	0.030 J	R	0.0050 U	0.016 JN	0.014 JN	0.017 JN
cis-Nonachlor	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.015 U	0.0050 U	0.017	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Dieldrin	0.010 U	0.010 U	0.011	0.010 U	0.030 U	0.010 U	0.020 U	0.010 U	0.010 U	0.010 U	0.010 U
Gamma-BHC (Lindane)	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.015 U	0.0050 U	0.010 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Heptachlor Epoxide	0.024	0.025	0.026 J	0.0098 J	0.078	0.027	0.027	0.0050 U	0.013	0.011	0.018
Hexabromobiphenyl	0.020 U	0.020 U	0.020 U	0.020 U	0.060 U	0.020 U	0.040 U	0.020 U	0.020 U	0.020 U	0.020 U
Hexachlorobenzene	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.015 U	0.0050 U	0.010 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Alpha-Chlordane	0.0050 U	0.0050 U	0.0058	0.0050 U	0.015	0.0050 U	0.010 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Gamma-Chlordane	R	R	R	0.0050 U	R	R	R	0.0050 U	R	0.0050 U	0.0050 U
Total Alpha + Gamma Chlordane	--	--	--	0.0050 U	--	--	--	0.0050 U	--	0.0050 U	0.0050 U
Toxaphene	0.20 U	0.20 U	0.20 U	0.20 U	0.60 U	0.20 U	0.40 U	0.20 U	0.20 U	0.20 U	0.20 U
trans-Nonachlor	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.015 U	0.0050 U	R	0.0050 U	0.0050 U	0.0050 U	0.0050 U

Notes:
- Grey shading indicates the presence of a non-detect result.
- Black shading indicates the presence of a rejected result.
mg/kg - milligrams per kilogram

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-4 -- Fish 1993 Pesticides and Mercury Data

Sampling Event	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation
Location ID	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07	ABSA-07
Sample ID	K40291W	K40292W	K40293W	K40294W	K40295W	K40296W	K40297W	K40298W	K40299W	K40300W	K40301W
ABSA	7	7	7	7	7	7	7	7	7	7	7
Sample Date	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993	10/12/1993
Species	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse	Golden Redhorse
Tissue	Whole Body	Whole Body	Whole Body	Whole Body	Whole Body	Whole Body	Whole Body	Whole Body	Whole Body	Whole Body	Whole Body
Composite (Y/N)	N	N	N	N	N	N	N	N	N	N	N
Length (in)	11.8	11.8	11.4	11.8	11.0	10.2	10.6	7.1	6.3	6.3	5.9
Weight (lbs)	0.7	0.7	0.4	0.7	0.4	0.4	0.4	0.1	0.1	0.1	0.1
Inorganics (mg/kg)											
Mercury	0.030	0.030	0.030	0.030	0.030	0.030	0.040	0.020	0.020	0.020	0.020
Pesticides (mg/kg)											
4,4'-DDD	0.010 UJ	0.019	0.027	0.030	0.022	0.021	0.025	0.021	0.020	0.026	0.024
4,4'-DDE	0.030 J	0.045 J	0.064 J	0.070 J	0.056 J	0.056 J	0.059 J	0.055 J	0.066 J	0.069	0.080 J
4,4'-DDT	R	R	R	R	R	R	R	R	R	R	R
Total DDT (4,4)	--	--	--	--	--	--	--	--	--	--	--
2-Bromobiphenyl	0.010 UJ	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
3-Bromobiphenyl	0.010 UJ	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
4-Bromobiphenyl	0.010 UJ	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U	0.010 U
Aldrin	0.037 J	0.047	0.054 J	0.053 J	0.050 J	0.045 J	0.053 J	0.053 J	0.055 J	0.045 J	0.058 J
cis-Nonachlor	0.0050 UJ	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Dieldrin	0.012 JN	0.013 JN	0.017 J	0.017 JN	0.013 JN	0.012 JN	0.015 JN	R	0.010 U	0.010 U	0.010 U
Gamma-BHC (Lindane)	0.0050 UJ	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Heptachlor Epoxide	0.032 J	0.044	0.046	0.044	0.045 JN	0.042 JN	0.048 J	0.048 J	R	0.044 J	R
Hexabromobiphenyl	0.020 UJ	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
Hexachlorobenzene	0.0050 UJ	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U
Alpha-Chlordane	0.0050 UJ	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0050 U	0.0093
Gamma-Chlordane	R	R	R	R	R	R	R	R	R	R	R
Total Alpha + Gamma Chlordane	--	--	--	--	--	--	--	--	--	--	--
Toxaphene	0.20 UJ	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U	0.20 U
trans-Nonachlor	0.0050 UJ	0.0050 U	R	R	R	0.0050 U	0.0050 U	0.0050 U	0.0050 U	R	0.0050 U

Notes:
- Grey shading indicates the presence of a non-detect result.
- Black shading indicates the presence of a rejected result.
mg/kg - milligrams per kilogram

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-5 -- Biota 1993 PCDD/PCDF Data (ng/kg)

Sampling Event		1993/1994 Aquatic Biota Investigation	1993/1994 Aquatic Biota Investigation
Location ID		ABSA-07	ABSA-07
Sample ID		K40286F	K40280F
ABSA		7	7
Sample Date		10/12/1993	10/12/1993
Species		Carp	Smallmouth Bass
Tissue		Fillet	Fillet
Composite (Y/N)		N	N
Length (in)		22.8	17.3
Weight (lbs)		5.3	2.4
Chemical Name	2005 WHO TEF		
1,2,3,4,6,7,8-HpCDD	0.01	13	0.40 U
1,2,3,4,6,7,8-HpCDF	0.01	0.73 J	0.30 U
1,2,3,4,7,8,9-HpCDF	0.01	0.20 U	0.40 U
1,2,3,4,7,8-HxCDD	0.1	0.51	0.40 U
1,2,3,4,7,8-HxCDF	0.1	0.50	0.20 U
1,2,3,6,7,8-HxCDD	0.1	3.2	0.34
1,2,3,6,7,8-HxCDF	0.1	0.36	0.20 U
1,2,3,7,8,9-HxCDD	0.1	0.53	0.40 U
1,2,3,7,8,9-HxCDF	0.1	0.16	0.43
1,2,3,7,8-PeCDD	1.0	0.96	0.34
1,2,3,7,8-PeCDF	0.03	0.44	0.20 U
2,3,4,6,7,8-HxCDF	0.1	0.39	0.25 UJ
2,3,4,7,8-PeCDF	0.3	2.1	0.60
2,3,7,8-TCDD	1.0	4.8	4.0
2,3,7,8-TCDF	0.1	5.9 UJ	4.1
OCDD	0.0003	9.3	1.2 U
OCDF	0.0003	0.40 U	1.0 U
Total TEQ		7.1	5.0

Notes:

1. Polychlorinated dibenzodioxin/polychlorinated dibenzofuran (PCDD/PCDF) data presented in *Addendum 2 to Draft Technical Memorandum 14 – Biota Investigation* (BBL, 1995).
2. The individual concentrations of PCDD and PCDF congeners were multiplied by their corresponding toxicity equivalency factors (TEFs) to yield Toxic Equivalent Concentrations (TEQs). The Total TEQ for the mixture is then derived by summing the TEQs for individual PCDDs and PCDFs.
3. TEF values for PCDD/PCDF compounds published in 2005 by the World Health Organization (WHO) were used to determine Total TEQs. The 2005 WHO TEFs for each congener are summarized in Table 2.4-B
4. Value used for non-detects and rejected results in the sum of the TEQ was zero.

ng/kg - nanograms per kilogram

- Grey shading indicates the presence of a non-detect result.

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-6 -- Biota 2001 Long-Term Monitoring Program PCDD/PCDF Data (ng/kg)

Sampling Event		MDCH 2001 Sampling Investigation	MDCH 2001 Sampling Investigation
Location ID		196	196
Sample ID		2001050-S21 (2001050-F021)	2001050-S22 (2001050-F022)
ABSA		7	7
Sample Date		9/18/2001	9/18/2001
Species		Carp	Carp
Tissue		Fillet	Fillet
Composite (Y/N)		N	N
Length (in)		26.5	31.0
Weight (lbs)		9.6	14.6
Chemical Name	2005 WHO TEF		
1,2,3,4,6,7,8-HpCDD	0.01	39	32
1,2,3,4,6,7,8-HpCDF	0.01	1.3 U	2.7
1,2,3,4,7,8,9-HpCDF	0.01	0.36 U	0.46 U
1,2,3,4,7,8-HxCDD	0.1	1.0 U	1.0 U
1,2,3,4,7,8-HxCDF	0.1	0.67 U	0.75 U
1,2,3,6,7,8-HxCDD	0.1	14	7.7
1,2,3,6,7,8-HxCDF	0.1	4.0	5.8
1,2,3,7,8,9-HxCDD	0.1	1.7 U	1.0 U
1,2,3,7,8,9-HxCDF	0.1	0.87 U	0.98 U
1,2,3,7,8-PeCDD	1.0	0.97 U	1.2 U
1,2,3,7,8-PeCDF	0.03	1.2 U	1.6 U
2,3,4,6,7,8-HxCDF	0.1	0.76 U	0.86 U
2,3,4,7,8-PeCDF	0.3	6.2	4.4
2,3,7,8-TCDD	1.0	25	5.8
2,3,7,8-TCDF	0.1	5.5	3.2
OCDD	0.0003	51	51
OCDF	0.0003	0.69 U	0.82 U
Total TEQ		30	9.2

Notes:

1. Polychlorinated dibenzodioxin/polychlorinated dibenzofuran (PCDD/PCDF) data collected as part of the Michigan Fish Contaminant Monitoring Program and provided by DNRE on July 27, 2010.
2. The individual concentrations of PCDD and PCDF congeners were multiplied by their corresponding toxicity equivalency factors (TEFs) to yield Toxic Equivalent Concentrations (TEQs). The Total TEQ for the mixture is then derived by summing the TEQs for individual PCDDs and PCDFs.
3. TEF values for PCDD/PCDF compounds published in 2005 by the World Health Organization (WHO) were used to determine Total TEQs. The 2005 WHO TEFs for each congener are summarized in Table 2.4-B
4. Value used for non-detects in the sum of the TEQ was zero.

ng/kg - nanograms per kilogram

- Grey shading indicates the presence of a non-detect result.

Georgia-Pacific LLC
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site
Supplemental Remedial Investigations/Feasibility Studies
Area 3/Former Otsego Impoundment SRI/FS Work Plan
Appendix B

Table B-7 -- Data Qualifier Notes

The data review process is an evaluation of data on a technical basis rather than a determination of contract compliance. As such, the standards against which the data are being weighed may differ from those specified in the analytical method. It is assumed that the data package represents the best efforts of the laboratory and had already been subjected to adequate and sufficient quality review prior to

During the review process, laboratory qualified and unqualified data are verified against the supporting documentation. Based on this evaluation, qualifier codes may be added, deleted, or modified by the data reviewer. Results are qualified with the following codes in accordance with USEPA National Functional Guidelines:

- Concentration (C) Qualifiers

  U The compound was analyzed for but not detected. The associated value is the compound quantitation limit.

  B The compound has been found in the sample as well as its associated blank, its presence in the sample may be suspect.

- Quantitation (Q) Qualifiers

  E The compound was quantitated above the calibration range.

  D Concentration is based on a diluted sample analysis.

- Validation Qualifiers

  J The compound was positively identified; however, the associated numerical value is an estimated concentration only.

  UJ The compound was not detected above the reported sample quantitation limit. However, the reported limit is approximate and may or may not represent the actual limit of quantitation.

  JN The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification. The associated numerical value is an estimated concentration only

  UB Compound considered non-detect at the listed value due to associated blank contamination.

  N The analysis indicates the presence of a compound for which there is presumptive evidence to make a tentative identification.

  R The sample results are rejected.

Two facts should be noted by all data users. First, the "R" flag means that the associated value is unusable. In other words, due to significant quality control (QC) problems, the analysis is invalid and provides no information as to whether the compound is present or not. "R" values should not appear on data tables because they cannot be relied upon, even as a last resort. The second fact to keep in mind is that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC serves to increase confidence in data but any value potentially contains error.

ARCADIS

Figures

OTSEGO DAM

USGS-2

OES6-5

KF4-4

50

KPT92-7

OTSEGO CITY DAM

SWK-4

OTSEGO

LEGEND:

- RIVER MILE MARKER
- RIVER CENTERLINE
- ROAD
- RAILROAD
- KALAMAZOO RIVER
- CREEKS/RIVERS/STREAMS/PONDS/LAKES
- INCORPORATED AREA
- COUNTY BOUNDARY

NON-PCB SAMPLE LOCATIONS

MEDIA:

- FLOODPLAIN SOIL
- SEDIMENT
- SURFACE WATER

NOTES:

1. KALAMAZOO RIVER SHORELINE APPROXIMATED FROM AERIAL PHOTOGRAPHY COLLECTED IN 1999.
2. BASEMAPPING PROVIDED BY THE MICHIGAN CENTER FOR GEOGRAPHIC INFORMATION.

0 1,100 2,200 Feet

GRAPHIC SCALE

GEORGIA-PACIFIC LLC
ALLIED PAPER, INC./PORTAGE CREEK/
KALAMAZOO RIVER SUPERFUND SITE
AREA 3/FORMER OTSEGO IMPOUNDMENT SRI/FS WORK PLAN
APPENDIX B - EXISTING NON-PCB DATA IN AREA 3

NON-PCB SAMPLE LOCATIONS

ARCADIS

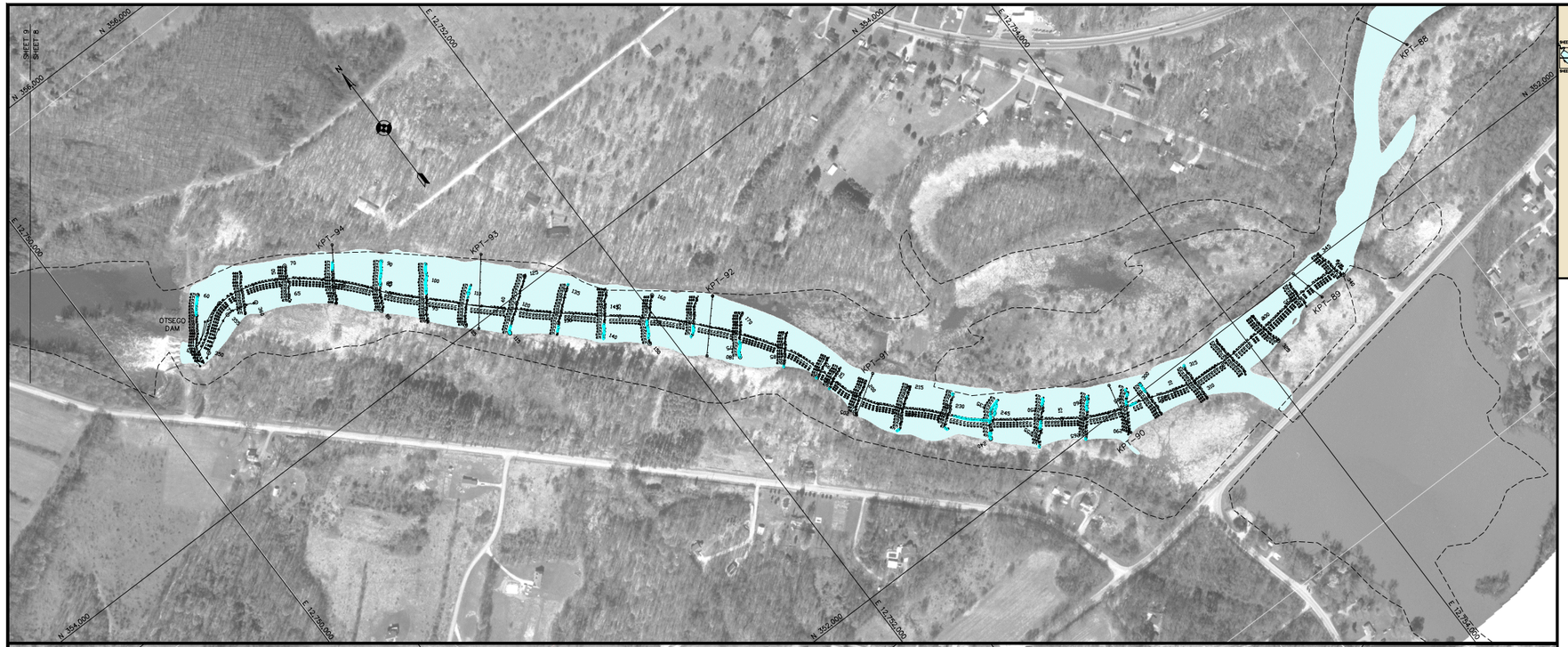
FIGURE
B-1

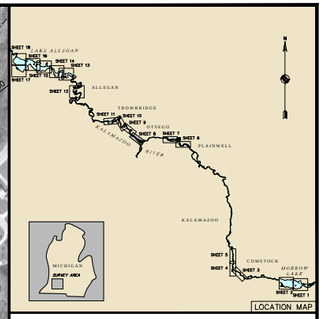
City: SYR Div/Group: 90 Created By: Sruti PUlugurtha Last Saved By: MKOHBERGER
KRSG - Otsego City (B0064529.0002.00500)
Q:\KRSG\OtsegoCityDam\ToOtsegoDam\SRIFS_WorkPlan\mxd\Non-PCB Sample Locations - Area 3_AppC_v2.mxd 3/23/2012 2:30:07 PM

ARCADIS

Appendix C

OSI 2000 Bathymetric Survey
Maps and DVD with Data





LOCATION MAP

LEGEND

ELEVATION POINT

NAVIGATION EVENT POINT

SURVEY VESSEL TACKLINE

ELEVATIONS APPROXIMATE DUE TO SHALLOW SITE CONDITIONS (SEE PROJECT REPORT)

DIGITAL SHORELINE PROVIDED BY CLIENT

KPT-61 EARLIER SURVEY TRANSECT (KPT)

PUSH PROBE AND INTERPRETED SEDIMENT TYPE

- SOFT SEDIMENTS (MUDS TO AQUEOUS SILTS)
- CLAY
- SILTY SAND-SANDY/SILT
- SAND
- SAND & GRAVEL
- ROCKS (COBBLES-BOULDERS & BEDROCK)
- STUMP
- SUBMERGED AQUATIC VEGETATION

NOTES

1. GRID SYSTEM IS IN FEET AND IS THE MICHIGAN STATE PLANE COORDINATE SYSTEM SOUTH ZONE (2113), NAD 83.
2. ELEVATIONS ARE IN FEET ABOVE NGVD (1929) BASED ON WATER LEVEL CORRECTIONS APPLIED TO SOUNDINGS. WATER LEVELS ARE BASED ON READINGS EITHER MADE BY OSI DURING THE COURSE OF THE SURVEY AT STAFF GAUGES INSTALLED BY LIMNO, INC. OR PROVIDED BY LIMNO-TECH, INC. FOLLOWING THE CONCLUSION OF THE INVESTIGATION. THE DECIMAL POINT INDICATES THE POSITION OF THE ELEVATION.
3. CONTOUR INTERVAL IS 2 FEET. CONTOURS WERE COMPUTER GENERATED USING "QUICKSURF" VERSION 5.2 (SCHREIBER INSTRUMENTS, INC.) OPERATING WITHIN "AUTOCAD" VERSION 14 (AUTODESK).
4. DIGITAL SHORELINE AND THE GEOREFERENCED ORTHO-PHOTOGRAPH PROVIDED BY LIMNO-TECH, INC. DISCREPANCIES IN THE SHORELINE POSITION BETWEEN THE TWO DATA SETS ARE SHOWN. IN THE URBAN KALAMAZOO SECTION OF THE RIVER, THE ORTHOPHOTOGRAPH HAS BEEN ADJUSTED 45 FEET WEST TO BEST-FIT ACTUAL FIELD OBSERVATIONS.
5. SIDE SCAN MOSAIC BASED ON IMAGES ACQUIRED USING A MARINE SONIC TECHNOLOGY, LTD., SEASCAN PC DIGITAL SIDE SCAN SONAR SYSTEM OPERATING AT 600 kHz. THE MOSAIC WAS GENERATED USING SOFTWARE IMAGING PACKAGES CARIS (UNIVERSAL SYSTEMS, LTD.) AND GEO DAS (OCEAN IMAGING CONSULTANTS, INC.). SIDE SCAN SONAR MOSAICS HAVE BEEN GENERATED AT AN APPROXIMATE 0.65 FOOT PIXEL RESOLUTION. AT THIS RESOLUTION, INDIVIDUAL TARGETS SLIGHTLY SMALLER THAN APPROXIMATELY 1.5 FEET CAN BE RESOLVED. AS PROJECT DRAWINGS HAVE BEEN CONSTRUCTED AT A SCALE OF 1"=200' MUCH OF THE SONAR RESOLUTION IS LOST IN THE PLOTTED PRESENTATION. IF ADDITIONAL DETAIL OF A PARTICULAR AREA IS NEEDED, PROJECT DRAWINGS SHOULD BE PLOTTED AT A LARGER SCALE TO ENHANCE RESOLUTION.
6. THE INFORMATION PRESENTED ON THESE DRAWINGS REPRESENTS THE RESULTS OF A SURVEY PERFORMED BY OCEAN SURVEYS, INC. ON 23 JULY-14 AUGUST 2000 AND CAN ONLY BE CONSIDERED AS INDICATING THE CONDITIONS EXISTING AT THAT TIME. REUSE OF THIS INFORMATION BY CLIENT OR OTHERS BEYOND THE SPECIFIC SCOPE OF WORK FOR WHICH IT WAS ACQUIRED SHALL BE AT THE SOLE RISK OF THE USER AND WITHOUT LIABILITY TO OSI.

SCALE: 1"=200'

200 0 200 400 600

CHECK GRAPHIC SCALE BEFORE USING

OCEAN SURVEYS, INC.

OLD SAYBROOK, CONNECTICUT

PREPARED FOR BLASLAND, BOUCK & LEE, INC.

HYDROGRAPHIC/GEOPHYSICAL DATA

KALAMAZOO RIVER
MORROW LAKE TO LAKE ALLEGAN, MICHIGAN
FORMER OTSEGO

PROJ. MGR.	SURVEY DATE:	SCALE:
J.D. SULLIVAN	23 JULY-14 AUG. 2000	1"=200'
DRAFTED BY:	DATE:	DWG. NO.
P.J. LACKEY	11 DECEMBER 2000	00ES056

ARCADIS

Appendix D

Data from Erosion Pin Survey

Attachment A

Erosion Pin Monitoring Data: Fall 2000 - Fall 2002

Kalamazoo River Study Group
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

March 2003

REPORT

Attachment A

Erosion Pin Monitoring Data: Fall 2000 - Fall 2002

Kalamazoo River Study Group
Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site

March 2003

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Table of Contents

FIGURES

APPENDICES

Introduction

This document is an interim progress report presenting the results of erosion pin surveys conducted in March and October 2001 and November 2002. The erosion pin surveys were performed as part of the ongoing erosion pin study, which is designed to characterize changes along the banks of the Kalamazoo River in the former Plainwell, Otsego, and Trowbridge Impoundments. The rationale and design of the study are described in Appendix S-1 of the *Supplement to the Kalamazoo River RI/FS* (Blasland, Bouck & Lee, Inc. [BBL], 2000a).

The specific objectives of the erosion pin study are to:

- Assess changes in the channel shape and river bank configuration over time;
- Estimate rates of river bank erosion within each of the three former impoundments; and
- Estimate the volume and mass of solids as well as the mass of polychlorinated biphenyls (PCB) contributed by the banks of each former impoundment to the river on an annual basis.

This interim report presents available survey results to date and provides a brief, preliminary interpretation of these data.

To achieve the erosion pin study objectives, surveyed profiles of the river banks were established in each former impoundment corresponding to sediment sampling transects established during the 1993 Remedial Investigation (RI) work. Within each former impoundment, 3 bank profiles (straight lines about 20 feet apart and perpendicular to the river flow) were established at both ends of 5 existing sediment transects, resulting in a total of 30 erosion pin profiles per impoundment (see Figures 1, 2, and 3 for locations). Each erosion pin profile includes 12 to 13 surveyed locations profiling the river bank. The locations are marked off from the top-of-bank location, and extend in a straight line back from shore into the floodplain (to a maximum distance of 25 feet back) and into the river channel, 5 feet beyond the bottom-of-bank location. Each location was surveyed for geographic coordinates and elevation, and the locations on land were physically marked with survey pins.

To identify each erosion pin profile individually, a three-tier nomenclature was applied. The first part of the erosion pin name scheme (EP-#) refers to the 1993 sampling transect number, the second part (A or B) refers to the side of the river, and the last (X, Y, or Z) refers to the individual survey line. All "A" locations refer to the left side of the river as one faces downstream (the south side) and all "B" locations refer to the right side of the river (the north side). Profile names including an "X" always designate the downstream-most location while "Z" is always the upstream-most profile associated with any given sampling transect. For example, a profile

identified as "EP-65AX" would be the most downstream survey line found in the vicinity of KPT65 on the south side of the river.

Long-term changes in the river banks are measured by periodically monitoring the elevations of each established erosion pin profile location and by monitoring the edge of the bank relative to the permanently placed erosion pins. Figure 4 shows an example of how both horizontal and vertical changes in a top-of-bank location are measured. Comparison of periodic survey results can establish erosion, deposition, or other changes in the bank profile, such as sloughing. Sloughing occurs when a steep bank fails and a portion of the upper bank soil is deposited in the river at the toe of the bank, reducing the bank slope.

Erosion pin placement, completed in the fall of 2000, is described and background information, general field information and procedures, and distance and elevation profiles are presented in the *Former Impoundment Erosion Pin Placement Report* (Erosion Pin Placement Report; BBL, 2000b). The erosion pin survey methods described here are used to conduct periodic (annual or semi-annual) surveys of the bank profiles. Three surveys have been conducted to date: March 2001 (results reported in BBL, 2001), October 2001 (results reported in BBL, 2002), and November 2002.

Survey Methods

The baseline profile (i.e. the initial profile for the bank erosion study) of the river banks was established at each erosion pin transect location and elevation during the 2000 baseline survey within the three former impoundments. In each of the three monitoring surveys, the location and elevation of each erosion pin were established by re-surveying the pin locations from the 2000 baseline survey. Consistent conventional land surveying methods were used for all survey activities, providing a horizontal accuracy of approximately 0.1 feet and a vertical accuracy of approximately 0.1 feet.

While the erosion pin placement completed in the fall of 2000 used survey benchmarks installed as part of the 1993/1994 RI, in March 2001, permanent benchmarks were installed specifically for the erosion pin study. The 2000 survey data presented in Appendix A represent recalculated elevations based on the new benchmarks. These data vary only slightly from the elevations presented in the Erosion Pin Placement Report (BBL, 2000b), but supercede those results.

During each monitoring survey, the bank locations were photographed. Plots of the bank profiles for all survey events are provided in Appendix A and bank profile survey data are presented in Appendix B. Photographs showing the surroundings at the erosion pin transects for the October 2000, the October 2001 and the November 2002 monitoring surveys are provided in Figures 1 through 30 of Appendix C. Photographs from the March

2001 surveys were presented in the Results of the March 2001 Survey of Erosion Pins Technical Memorandum (BBL, 2001) and are not presented here. Field notes from the erosion pin surveys are contained in Appendix D.

River Flow Conditions During the Bank Erosion Pin Surveys and the Erosion Pin Study

Flow data from the Kalamazoo River indicate that no exceptionally high river flow events have occurred since pin installation was completed in the fall of 2000. Figures 5 and 6 present the USGS flow data time series since October 2000 for the USGS gages near Allegan and Comstock, respectively. The maximum daily mean flows during the 2-year period were 5,050 cubic feet per second (cfs) on February 15, 2001 at Allegan and 4,230 cfs on February 14, 2001 at Comstock. Based on flow return frequency analysis conducted on USGS flow data collected at Comstock prior to 1998, 4,230 cfs corresponds to approximately the 6-year return flow. By comparison, the 50-year return flow is 6,250 cfs, or approximately 48% greater than the 6-year return flow at Comstock.

Interim Erosion Pin Monitoring Results

Changes in the bank profiles over time were assessed by comparing the results of the March 2001 (2001A survey), October 2001 (2001B survey), and November 2002 (2002 survey) surveys to the baseline survey completed by October 2000 (2000 survey). As described in the erosion pin placement report, the location and elevation of each erosion pin was surveyed over time (see Figures 1 through 3 for pin locations). To provide a general interpretation of results in the river along the length of each impoundment, the results for each set of three erosion pin lines in the vicinity of a sediment sampling transect were classified using one of the following descriptions: minimal change, erosion, sloughing, deposition, or intermittent erosion/deposition. Table 1 summarizes these qualitative observations. Where intermittent erosion/deposition is indicated in Table 1, the direction of change in the river bottom elevation at the toe of the bank varied among surveys, indicating accumulation and periodic erosion of sediments at the toe of the bank in these locations. Where deposition is indicated in Table 1, sediment accumulation over time in the river at the toe of the bank was apparent in the survey results.

Table 1. Summary of Qualitative Observations from Transect Comparisons since October 2000.

Impoundment	Transects	Left Bank* (looking downstream)	Right Bank* (looking downstream)
Former Plainwell Impoundment	EP-57	Erosion and sloughing	Deposition
	EP-60	Minimal change	Deposition
	EP-62	Minimal change and erosion	Minimal change and deposition
	EP-65	Minimal change	Deposition
	EP-67	Minimal change and erosion	Minimal change and erosion
Former Otsego Impoundment	EP-85	Minimal change	Minimal change
	EP-87	Erosion	Erosion
	EP-89	Erosion and intermittent erosion /deposition	Erosion and minor erosion
	EP-90	Erosion and deposition	Intermittent erosion/deposition
	EP-94	Erosion	Minimal change and deposition
Former Trowbridge Impoundment	EP-99	Minimal change	Sloughing and intermittent erosion/deposition
	EP-101	Erosion and deposition	Bank sloughing and erosion
	EP-102	Erosion and sloughing	Minimal change and erosion
	EP-103	Deposition and sloughing	Minimal change and deposition
	EP-106	Erosion	Minimal change

***Note:** Summary descriptions of observed bank profile changes at the three erosion pin lines in the vicinity of each transect location; often the individual erosion pin lines showed variable changes over time.

Additional observations and preliminary interpretations from the erosion pin survey data are provided below.

- **Bank erosion is a source of sediment and PCB to the Kalamazoo River in all three of the former impoundments; however, not all areas within the impoundments have experienced erosion over the 2-year period since erosion pin placement.** Sampling has shown that the bank soils and sediments contain concentrations of PCBs. Based on the qualitative descriptions of bank changes over time shown in Table 1, the erosion pin survey results indicate that bank erosion and/or bank sloughing occurred at 40% (4 of 10) of the locations surveyed in the former Plainwell Impoundment, 60% (6 of 10) of the locations in the former Otsego Impoundment, and 70% (7 of 10) of the locations in the former Trowbridge Impoundment.

  Additionally, the survey data indicate that significant deposition has occurred along the toe of the banks in some locations, apparently unrelated to bank soil losses. Figure 7 provides an example of a

bank profile from the former Plainwell Impoundment at which deposition occurred in the near shore area at the toe of the bank. Figure 8 shows an example of a bank profile from the former Plainwell Impoundment where bank erosion has occurred. Figure 9 shows an example of a bank profile from the former Plainwell Impoundment where bank sloughing is apparent.

- **There are instances of a high degree of small-scale spatial variability.** This is evident at certain locations by comparing results for the sets of three erosion pin lines spaced 20 feet apart. For example, at the left bank location at transect EP-99 in the former Trowbridge Impoundment, erosion pin lines EP-99BX and EP-99BY show deposition at the toe of the bank and no change in the top of bank or the bank profile. The results for erosion pin line EP-99BZ show significant bank erosion and reduction in the top of bank elevation due to bank soil loss, as well as sediment accumulation at the toe of the bank that may be from bank sloughing or sediment deposition (see pages 64-66 in Appendix A).

- **Relatively high rates of bank erosion are occurring at various locations within each of the three former impoundments (see Table 2).** In the former Plainwell Impoundment at location EP-62AY, soil loss along the entire face of the bank and bank toe occurred. Based on the changes in the top of bank position, the data suggest a rate of bank retreat at this location of 0.68 ft/year over the last two years (see figure on page 14 of Appendix A). At location EP-94AY in the former Otsego Impoundment, a similarly high rate of erosion was measured, with the entire bank face and bank toe retreating at an average rate of 1.17 ft/year over the last two years (see figure on page 56 of Appendix A). In the former Trowbridge Impoundment, at location EP-106AX, soil loss from a more gradually sloped bank was measured. The top of bank location established at the beginning of the survey lost 3.70 ft of soil (measured horizontally) indicating an approximate rate of bank retreat of 1.85 ft/year at this location (see page 85 of Appendix A). Table 2 shows estimated horizontal and vertical bank erosion rates for example transects with vertical changes in the top of bank location greater than 0.5 feet within each former impoundment.

Table 2. Examples of Bank Erosion Rates Where Top of Bank Changes are Greater than 0.5 feet within Each Former Impoundment (October 2000 through November 2002)

Former Impoundment	Location	Horizontal Top of Bank Change	Vertical Top of Bank Change
Plainwell	EP-62AY	1.36 ft, 0.68 ft/yr	1.22 ft, 0.61 ft/yr
	EP-65AY	0.43 ft, 0.22 ft/yr	0.81 ft, 0.41 ft/yr
	EP-67BX	0.13 ft, 0.07 ft/yr	1.63 ft, 0.82 ft/yr
	EP-67BY	1.55 ft, 0.78 ft/yr	1.83 ft, 0.92 ft/yr
Otsego	EP-87AZ	0.78 ft, 0.39 ft/yr	2.56 ft, 1.28 ft/yr
	EP-89BX	0.62 ft, 0.31 ft/yr	0.64 ft, 0.32 ft/yr
	EP-94AY	2.64 ft, 1.32 ft/yr	2.03 ft, 1.02 ft/yr
Trowbridge	EP-99BZ	1.94 ft, 0.97 ft/yr	1.89 ft, 0.95 ft/yr
	EP-101BX	1.46 ft, 1.23 ft/yr	1.11 ft, 0.56 ft/yr
	EP-101BY	0.45 ft, 0.23 ft/yr	1.24 ft, 0.62 ft/yr
	EP-106AX	3.70 ft, 1.85 ft/yr	0.50 ft, 0.25 ft/yr

- **Visual observations made during the repeat surveys of the erosion pin locations confirm the survey and erosion pin measurements.** Bank sloughing can occur due to several factors, including erosional undercutting, repeated wetting and drying of the banks, and repeated freezing and thawing of the banks. Instances of bank undercutting were observed in the former impoundments by field staff conducting the erosion pin surveys. Wetting and drying causes desiccation cracking of the bank soils leading to calving of blocks of soil from the bank to the river. Repeated freezing and thawing can form fracture planes within the bank soils causing similar loss of relatively large pieces of bank soil to the river. Blocks of sediment that have fallen off the banks were noted along the banks of the former impoundment during the erosion pin surveys. Examples of bank sloughing are evident at locations such as EP-57AZ (page 3 in Appendix A) and EP-103AZ (page 81 in Appendix A). In addition, some of the observations described here are apparent in the photographs of erosion pin transect locations provided in Appendix C.

- **Although bank erosion and bank sloughing was observed during the October 2000 to November 2002 period in which the maximum flow equals the 6-year return flow, larger floods that may occur in the future may represent larger bank erosion potential.** The largest flows that occurred during this period, 4,230 cfs at Comstock, is approximately equal to the 6-year return interval flow. While significant amounts of bank erosion and sloughing were observed, larger rates would be expected during larger flood events.

The bank erosion pin data provide evidence that the banks are a significant continuing source of solids to the Kalamazoo River. Although volumes of materials or the mass of PCBs associated with the losses or gains of materials in the former impoundments were not estimated for this report, these data show that there are locations within each of the impoundments that have lost significant amounts of bank soils potentially containing PCB to the river over the 2-year study period.

References

Blasland, Bouck & Lee, Inc. (BBL). 2000a. *Supplement to the Phase I RI/FS Report - Allied Paper, Inc./Portage Creek/Kalamazoo River Superfund Site* (Syracuse, NY: October 2000).

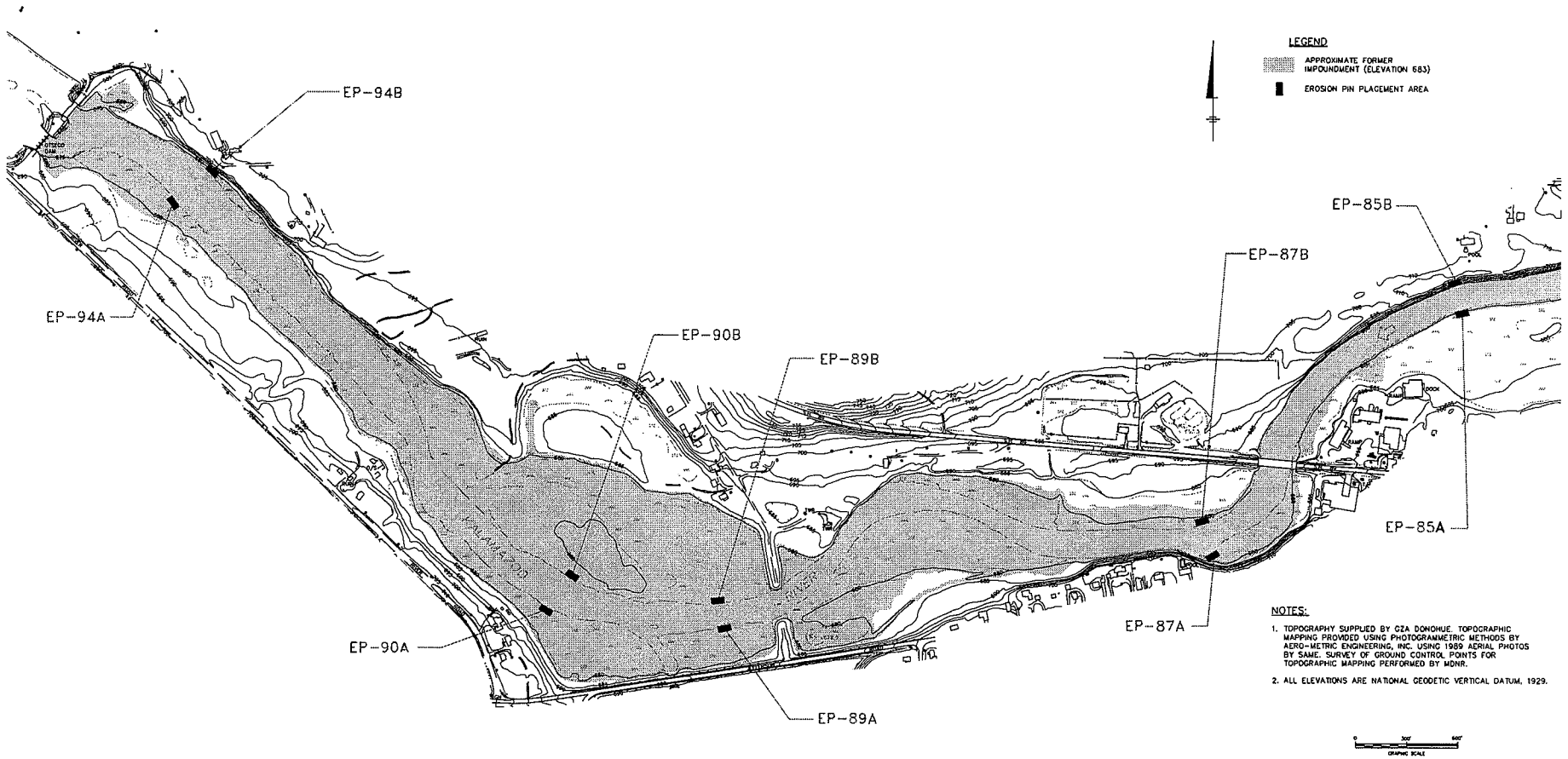
BBL. 2000b. *Former Impoundment Erosion Pin Placement Report* (Syracuse, NY: December 2000).

BBL. 2001. *Technical Memorandum – Results of the March 2001 Survey of Erosion Pins* (Syracuse, NY: July 2001).

BBL. 2002. *Technical Memorandum – Results of the October 2001 Survey of Erosion Pins* (Syracuse, NY: March 2002).

Figures

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists



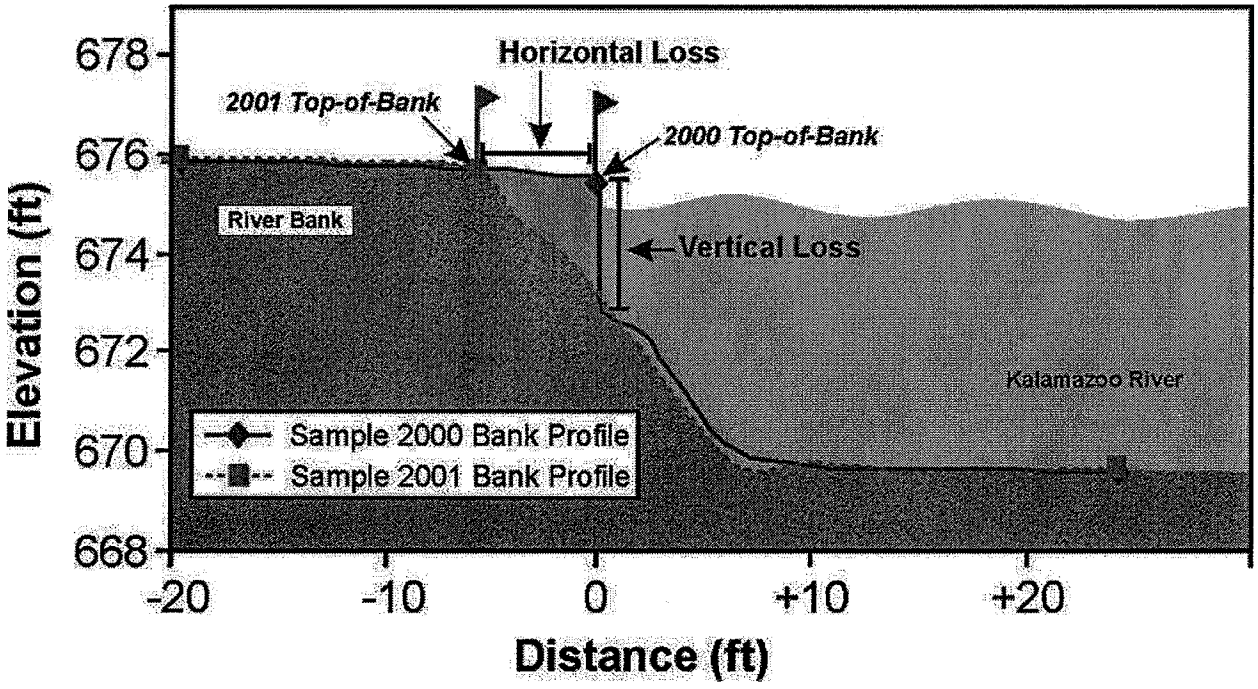
KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE
EROSION PIN MONITORING DATA
FALL 2000–FALL 2002

EROSION PIN PLACEMENT IN THE FORMER OTSEGO IMPOUNDMENT

BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 2

L: CAD*, OFF=REF*
P: STD-PCP/DL
01/03/03 SYR-54-KMD GWS KMD
04530114/04530002.DWG



KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000 - FALL 2002

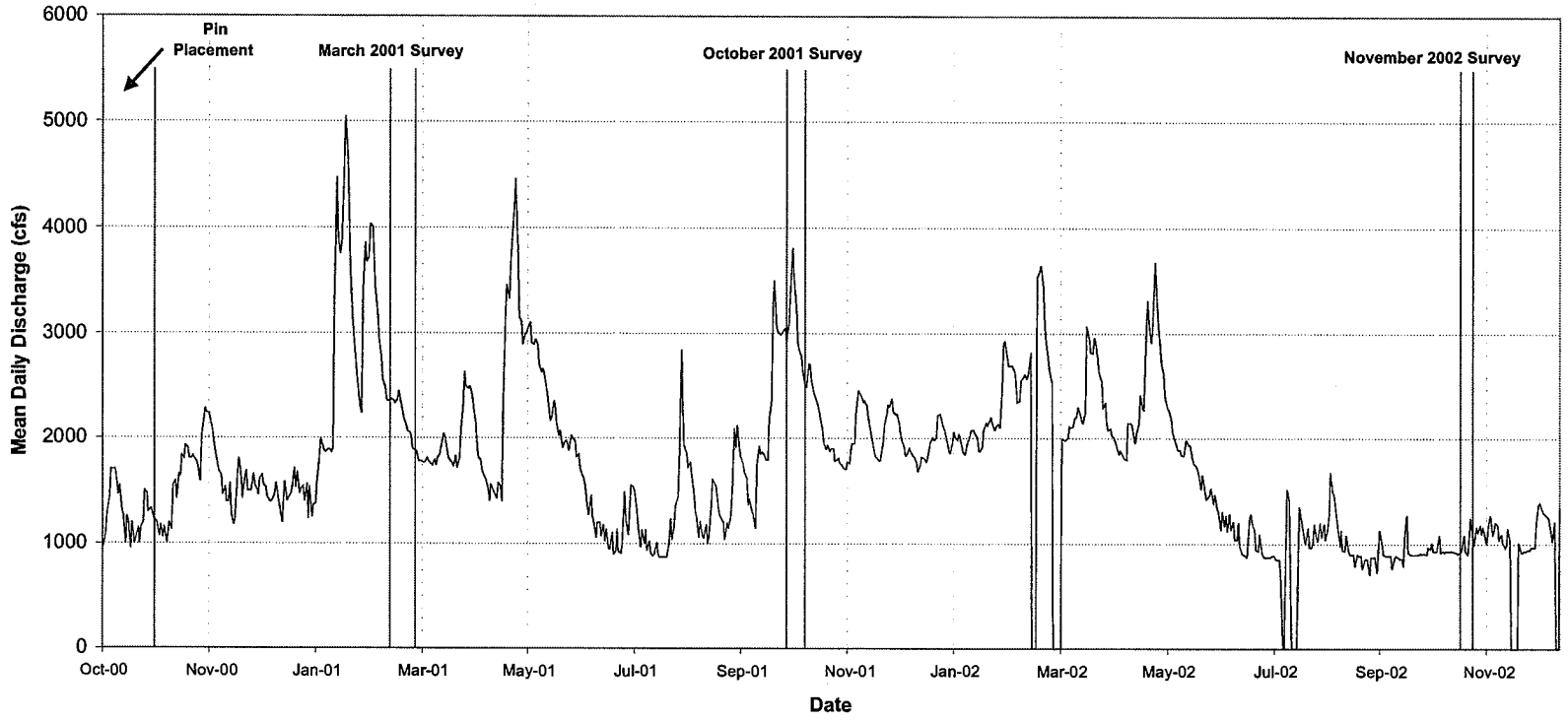
EXAMPLE OF HORIZONTAL AND VERTICAL BANK LOSS COMPARISON

BBL® BLASLAND, BOUCK & LEE, INC. engineers & scientists

FIGURE 4

01/08/03 SYR-D54-DJH
64530114/64530N01.CDR

Kalamazoo River at Allegan
Mean Daily Discharge
2000 - 2002
(based on available provisional data from the USGS Gage 04107850)



KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000 - FALL 2002

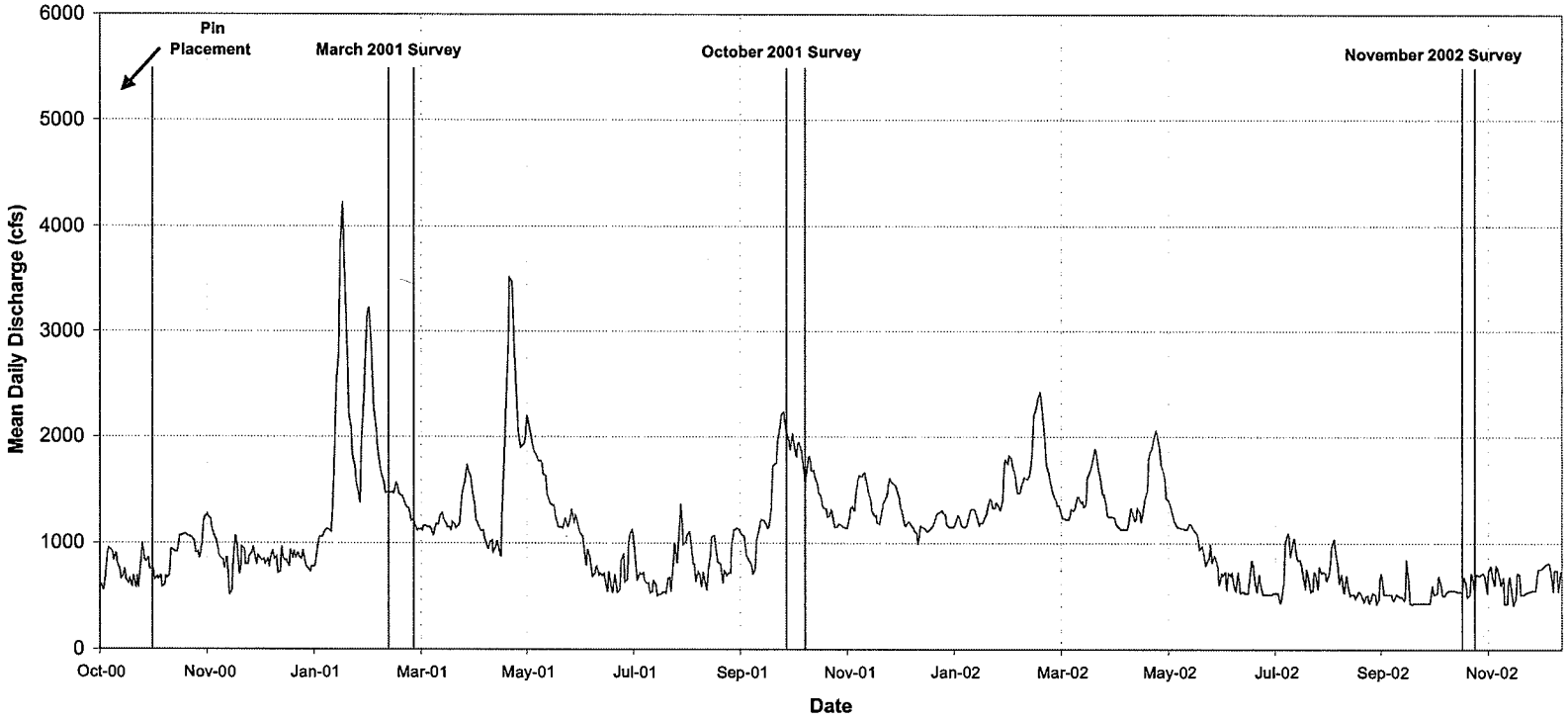
MEAN DAILY DISCHARGE FOR THE KALAMAZOO RIVER NEAR ALLEGAN, MI

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE 5

01/03/03 SYR-D54-DJH
64530114/64530N02.CDR

Kalamazoo River at Comstock
Mean Daily Discharge
2000 - 2002
(based on available provisional data from the USGS Gage 04106000)



KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000 - FALL 2002

MEAN DAILY DISCHARGE FOR THE KALAMAZOO RIVER AT COMSTOCK, MI

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

FIGURE
6

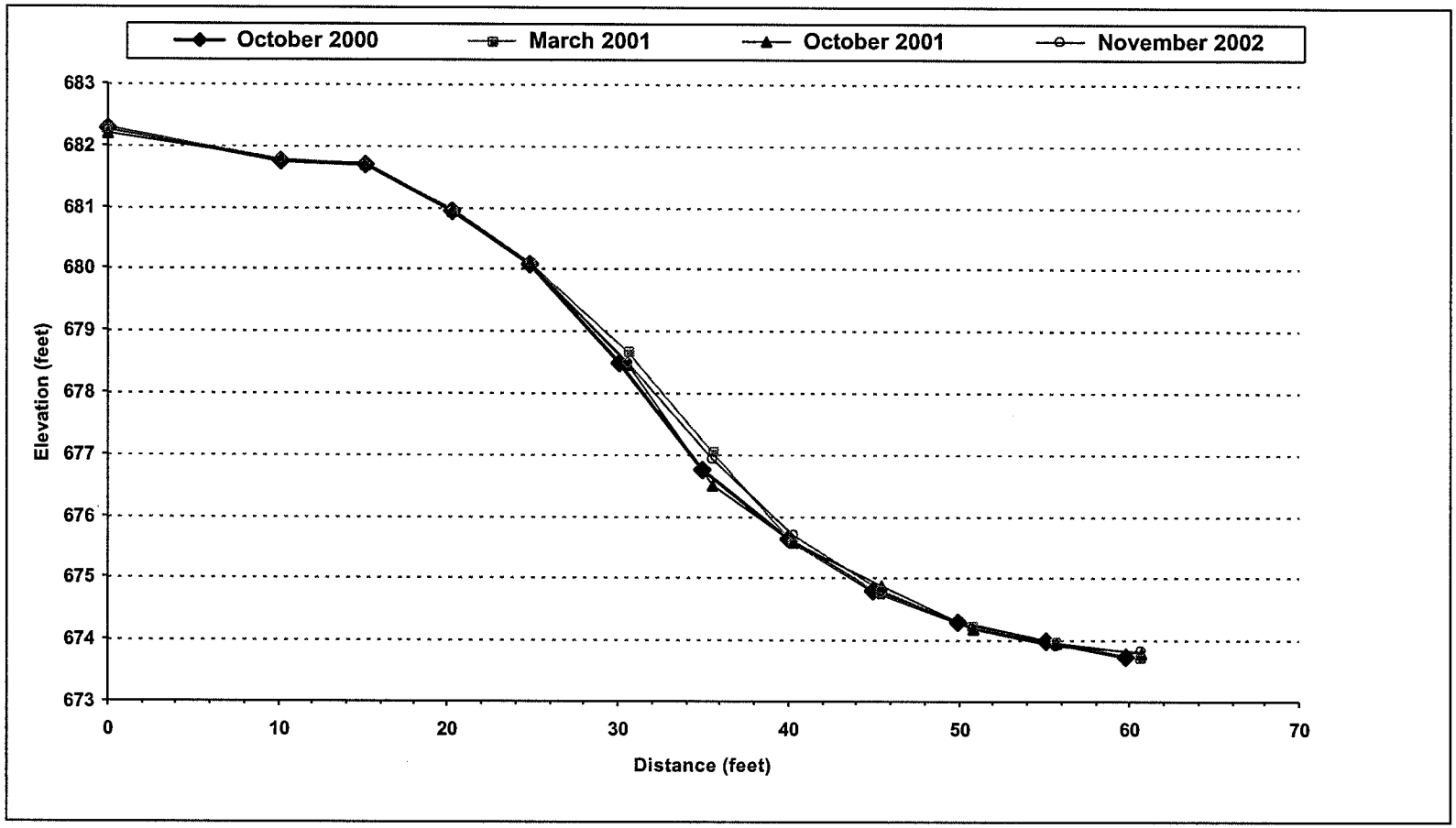
01/08/03 SYR-D54-DJH
64530114/64530N03.CDR

Appendix A

Bank Profiles

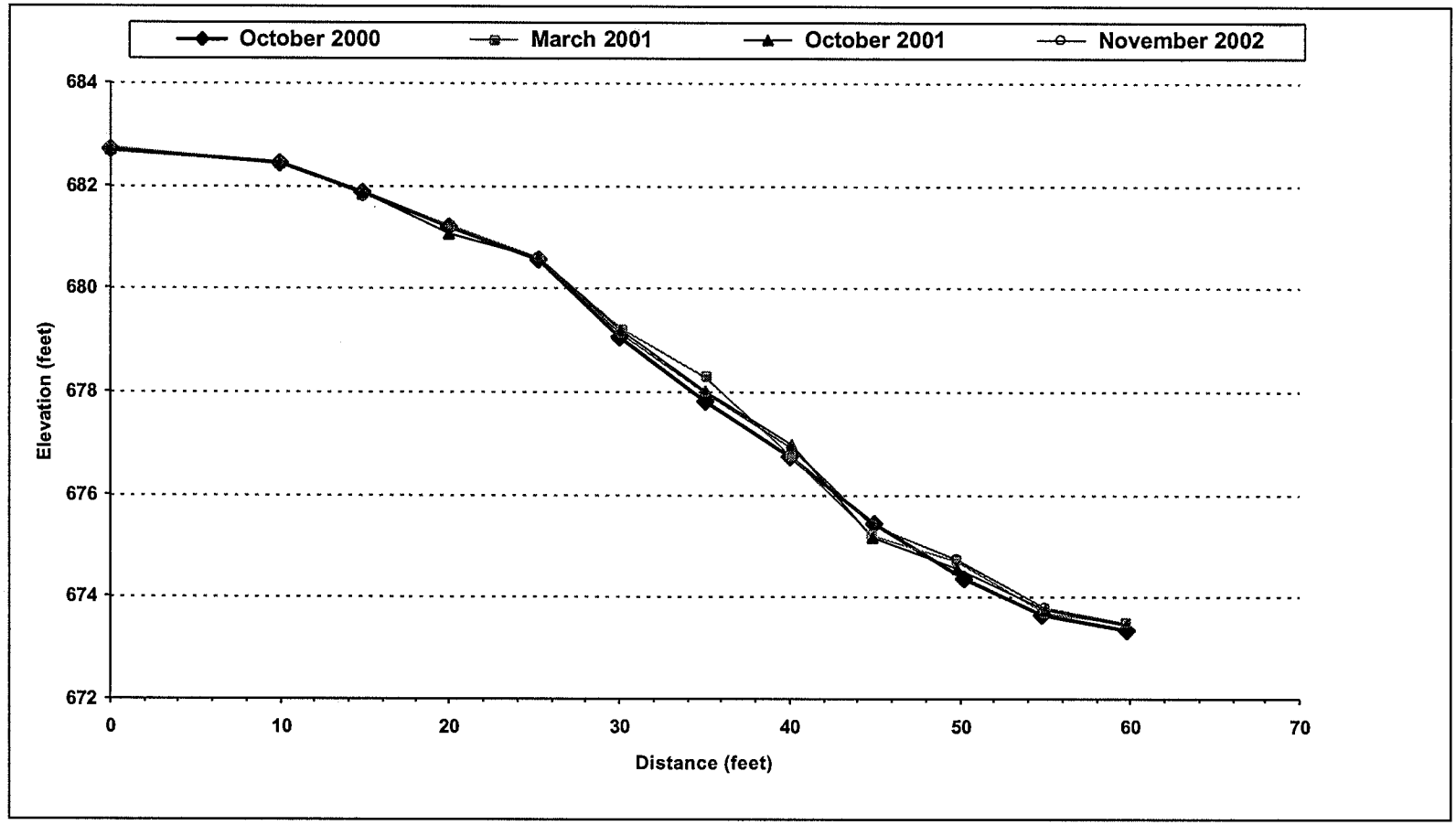
BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

Former Otsego Impoundment - EP-85AX

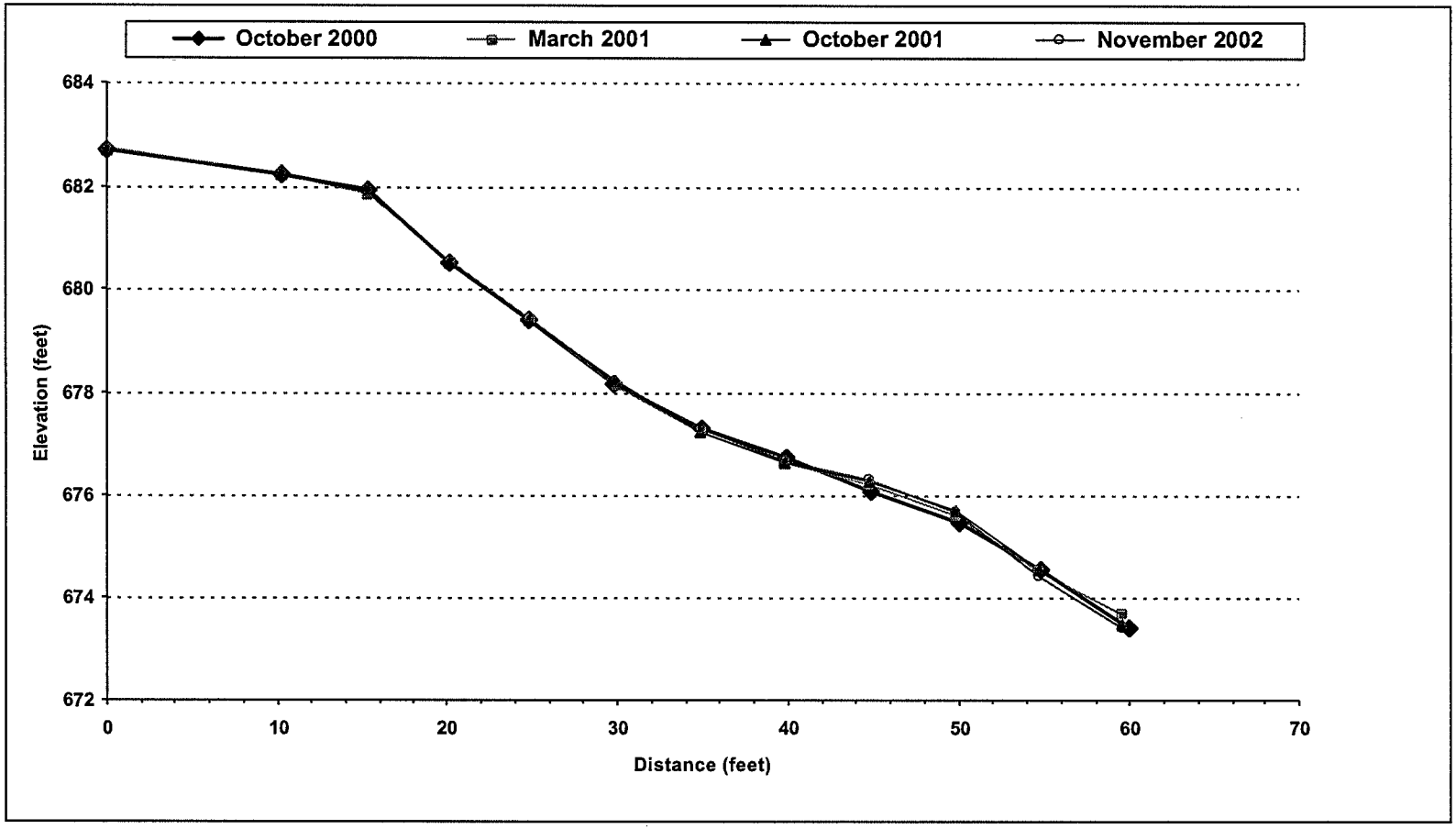


Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-85AY



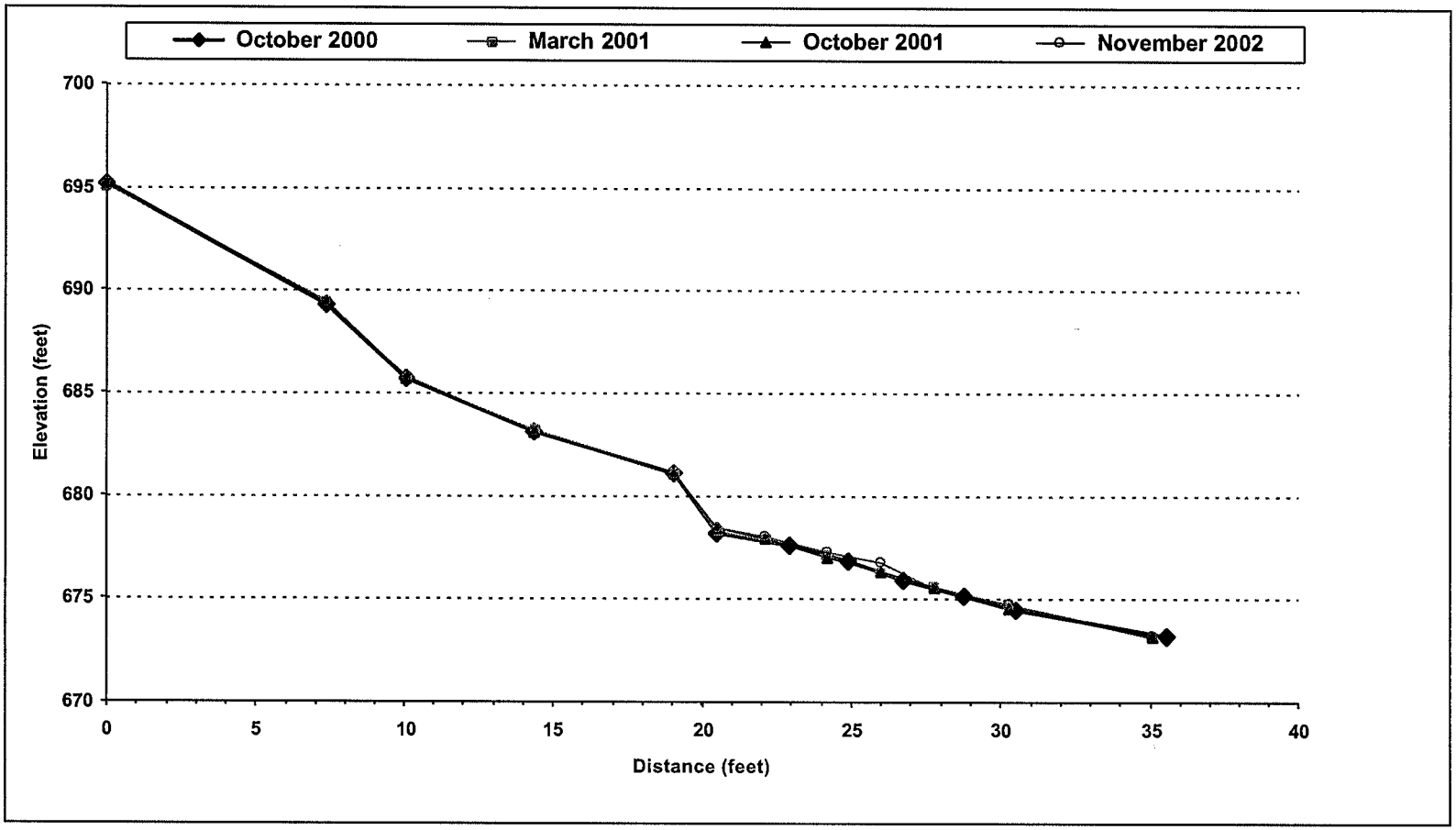
Former Otsego Impoundment - EP-85AZ



Elevations are presented in feet above mean sea level (NVGD 1929).

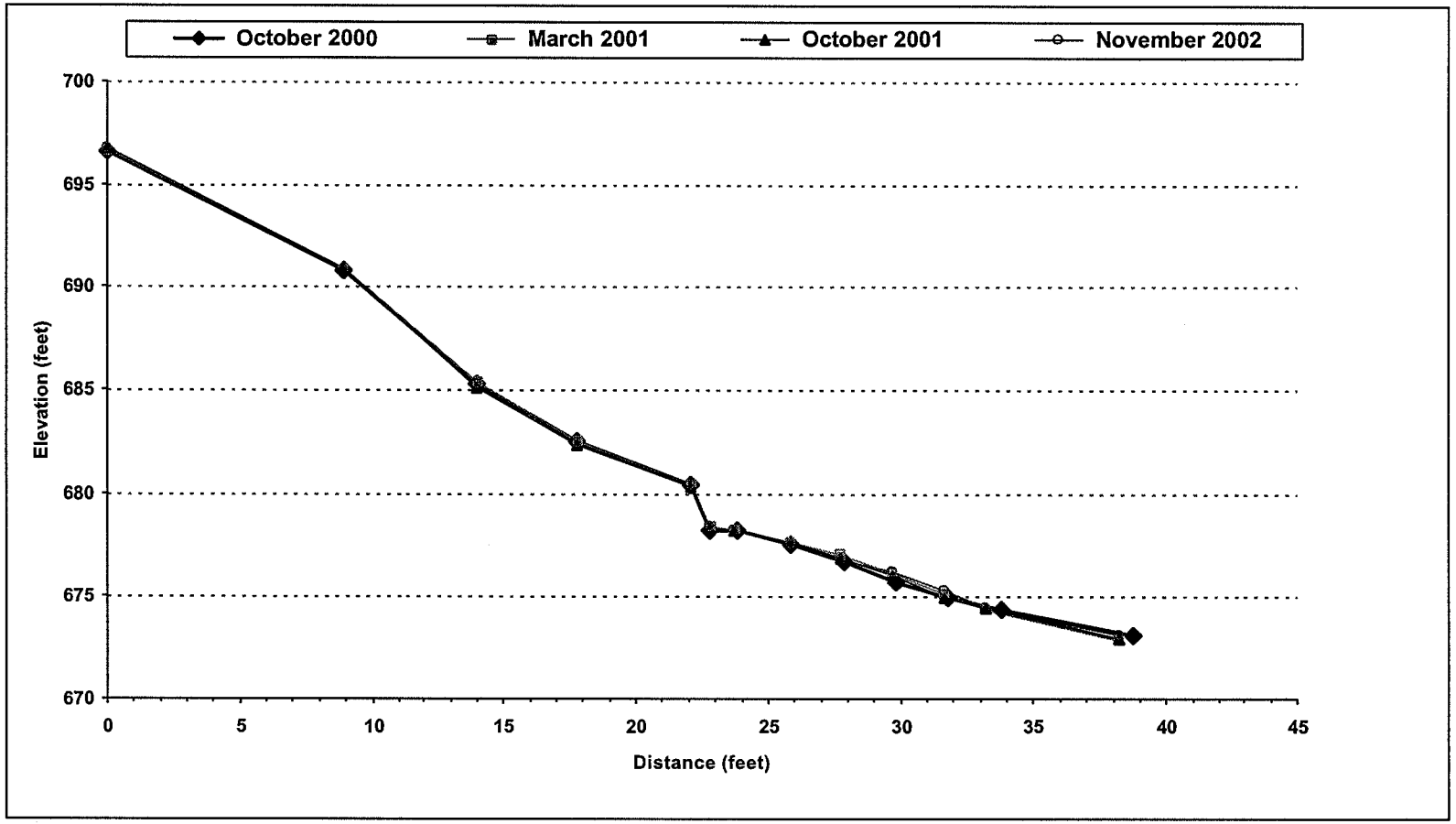
Appendix A - 2000, 2001 and 2002 Erosion Pin Profiles

Former Otsego Impoundment - EP-85BX



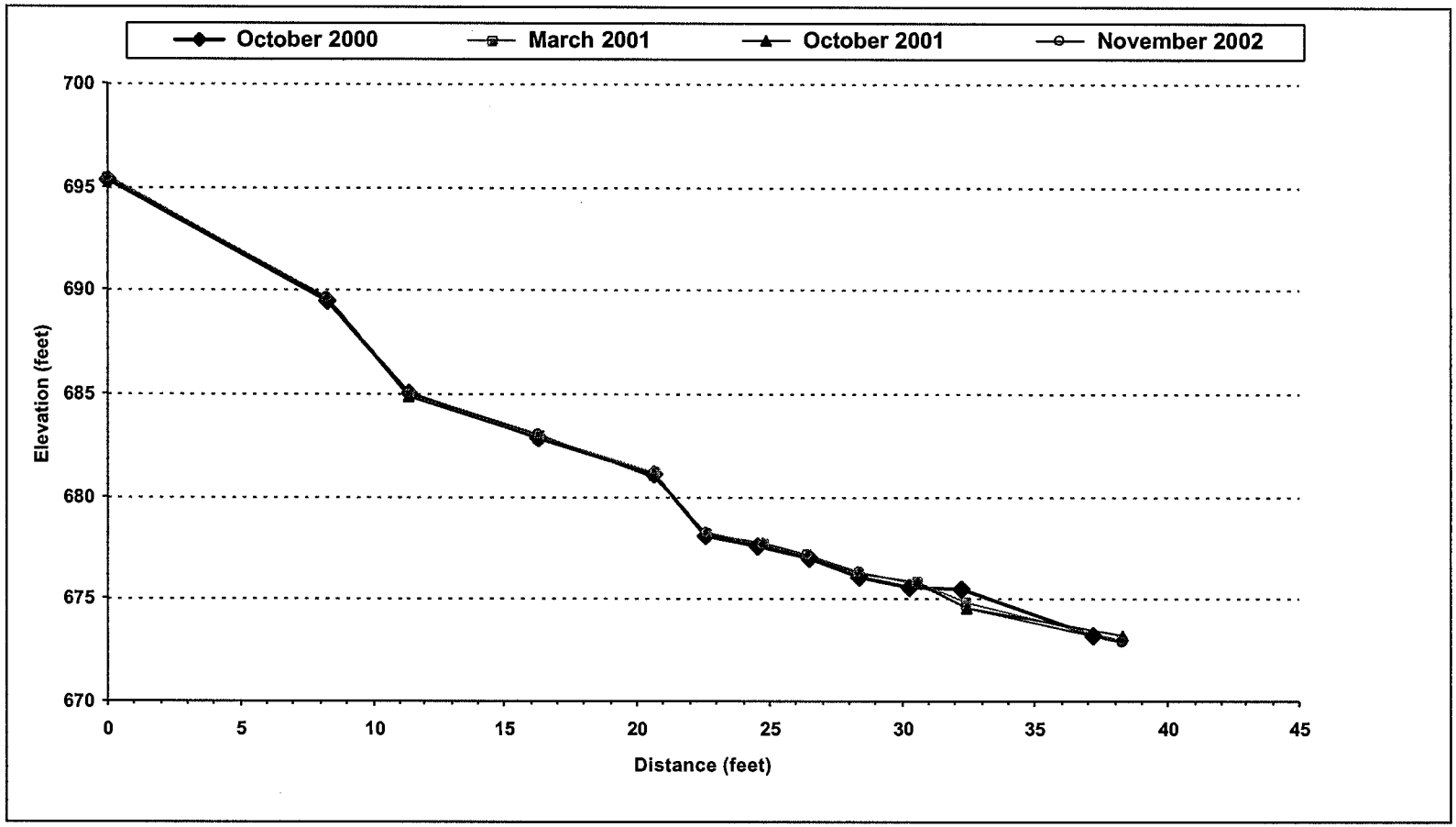
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-85BY



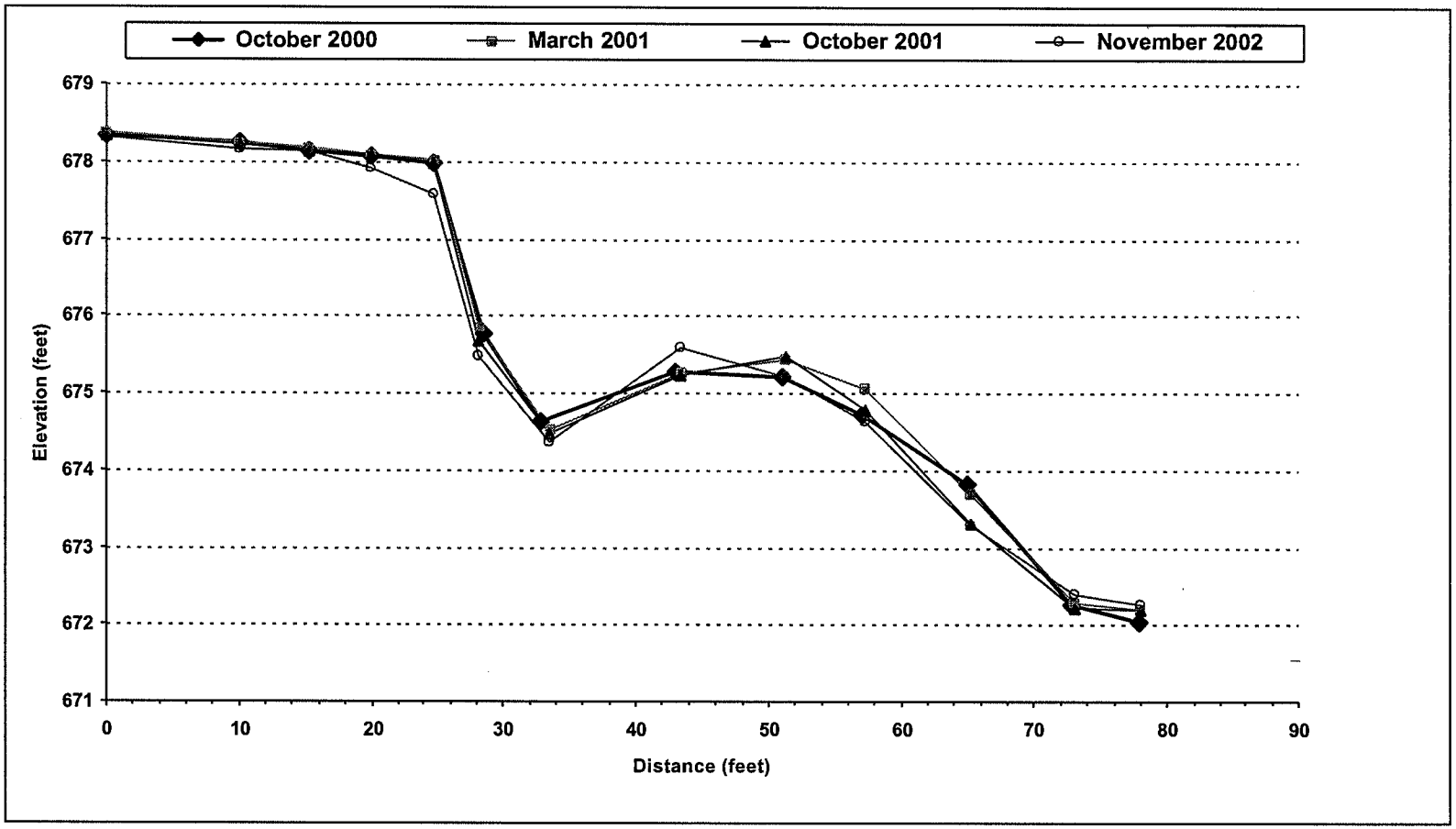
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-85BZ



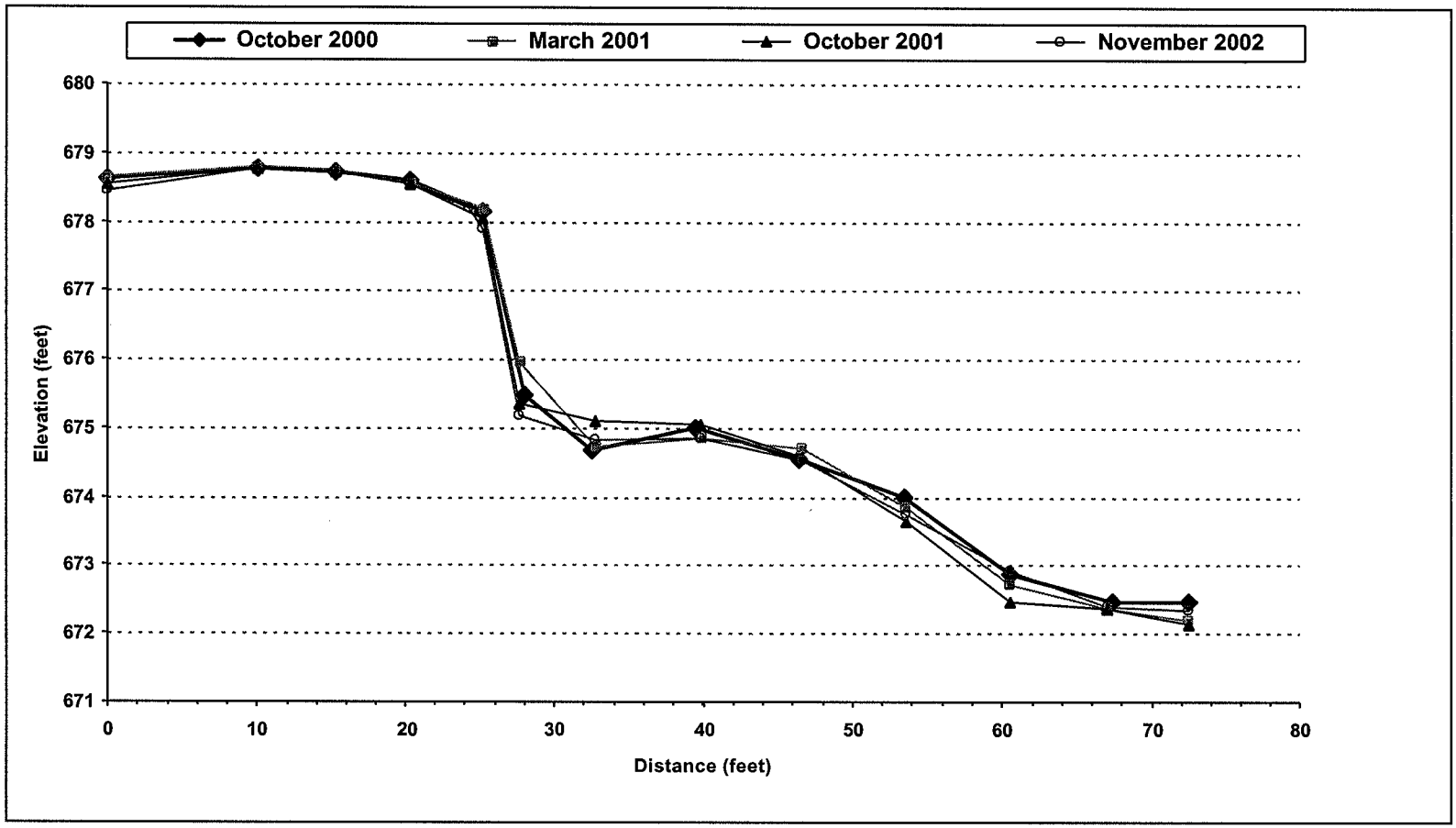
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-87AX



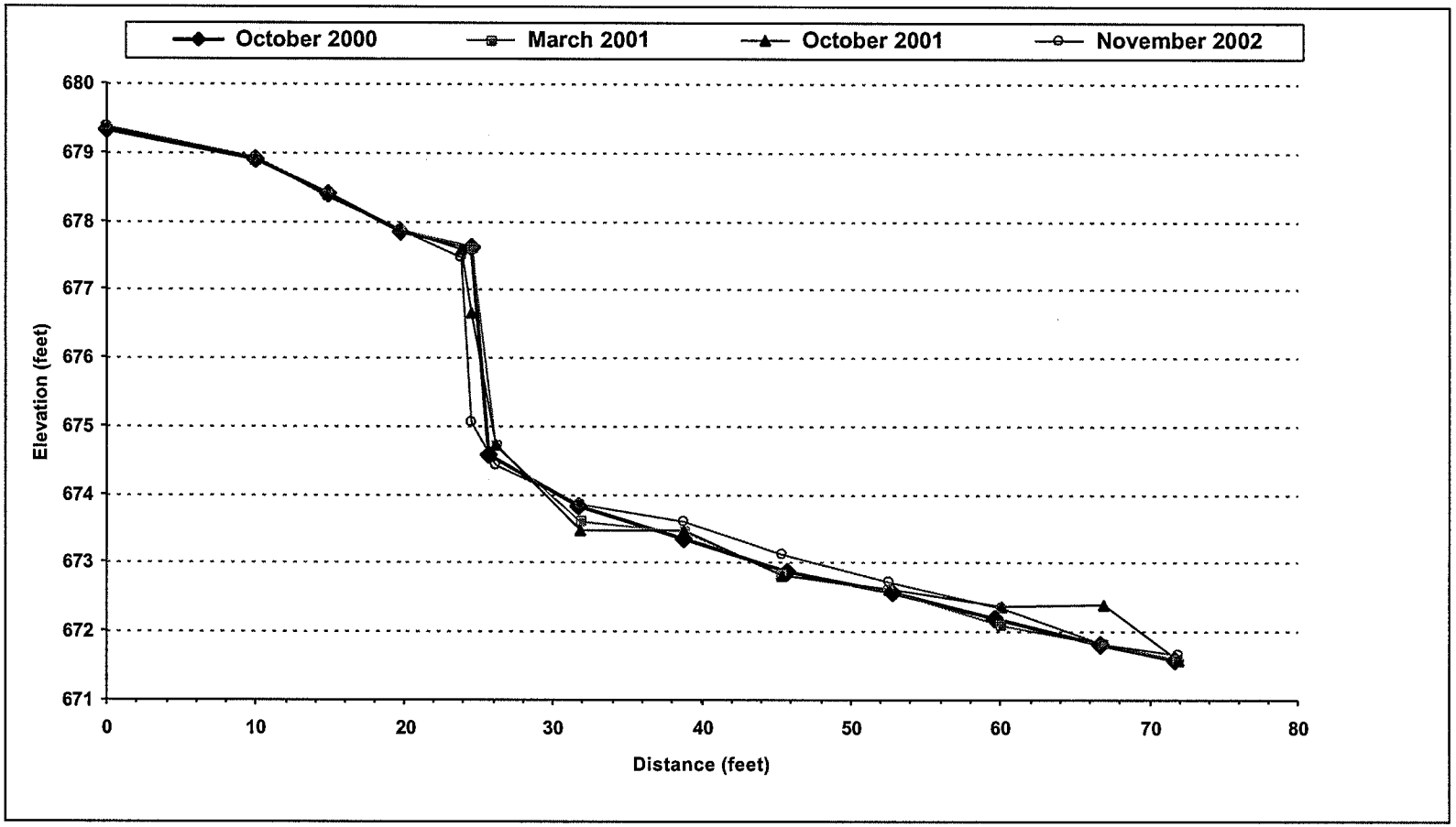
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-87AY



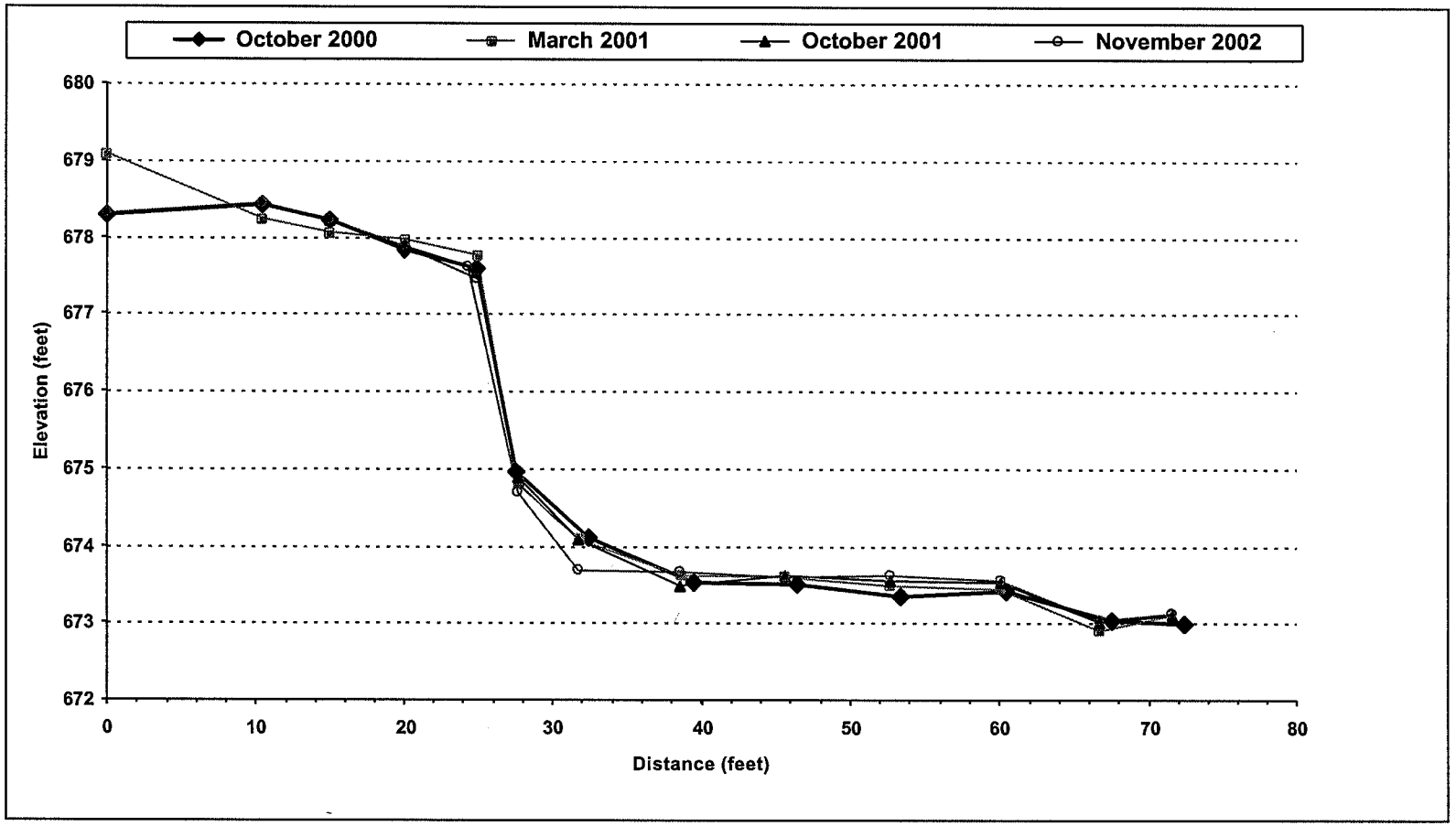
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-87AZ

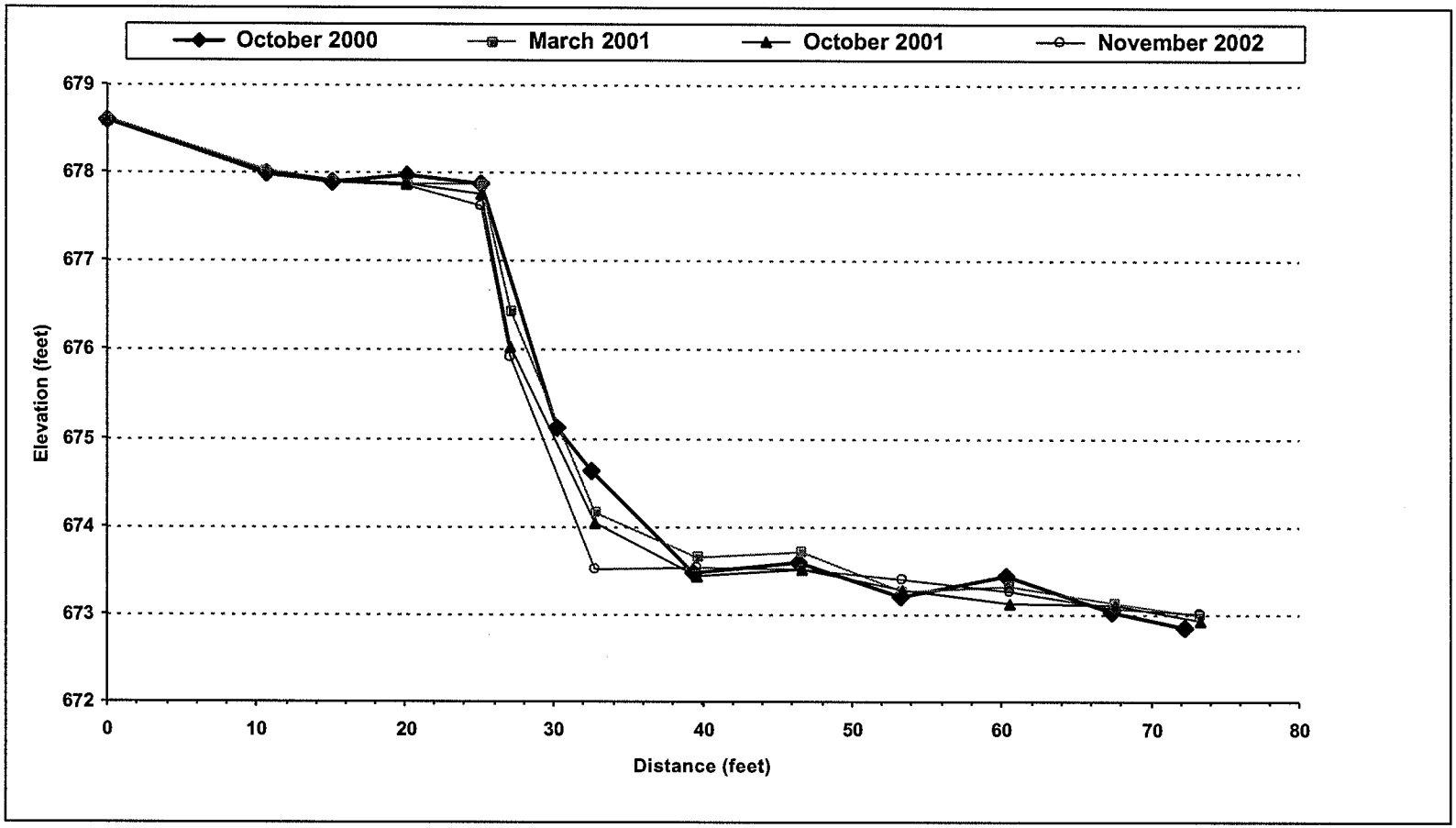


Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-87BX

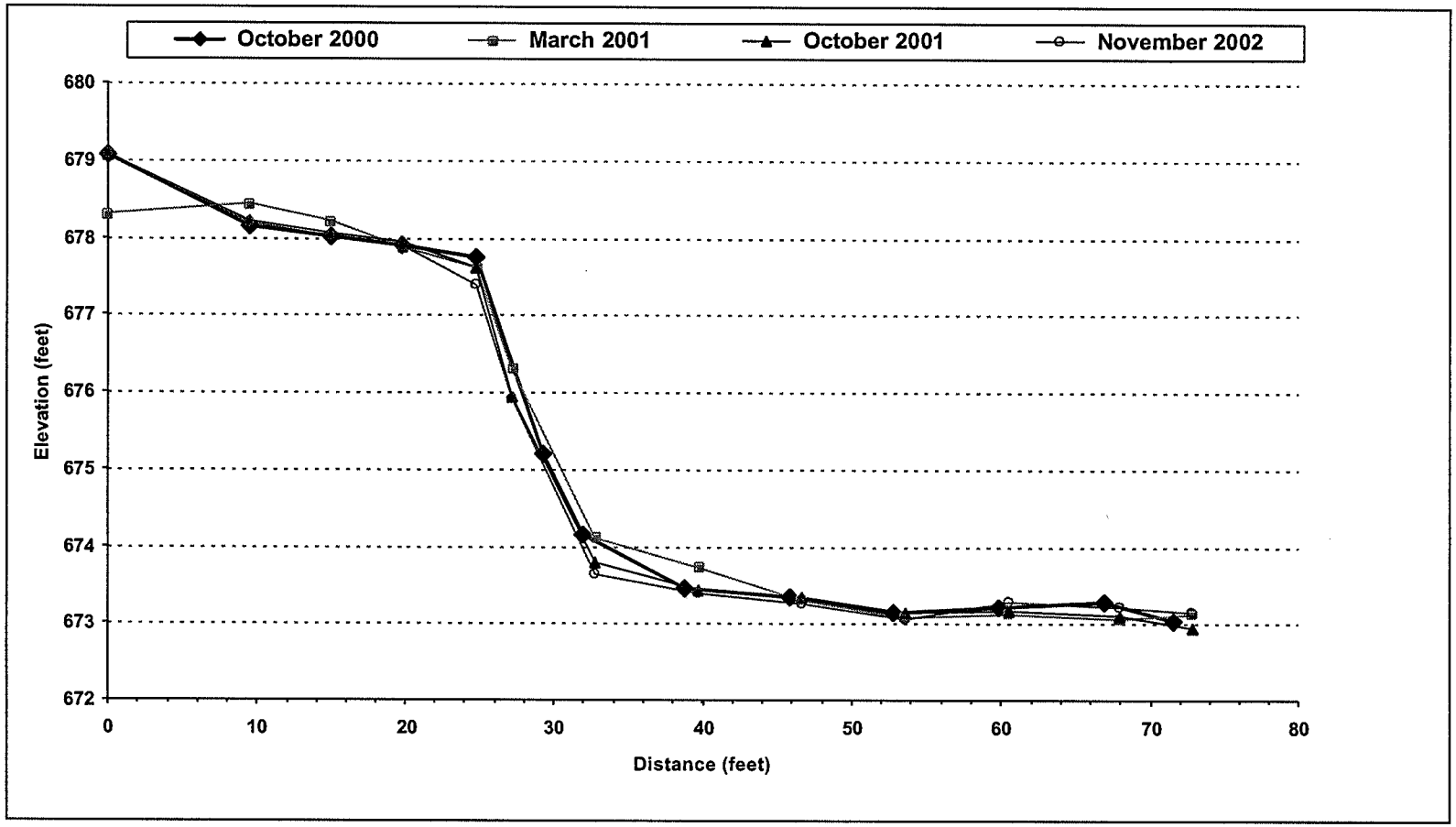


Former Otsego Impoundment - EP-87BY



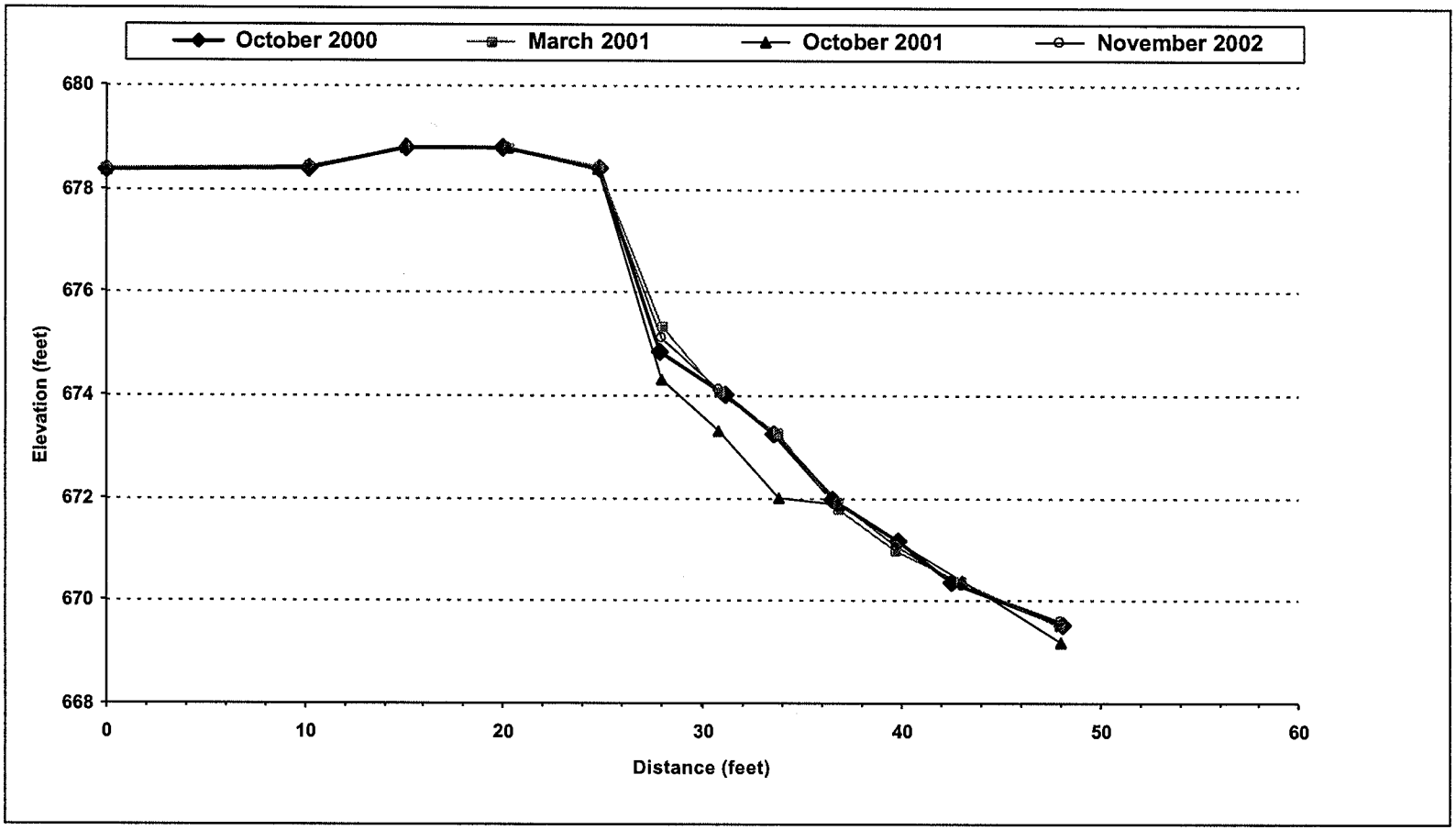
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-87BZ



Elevations are presented in feet above mean sea level (NVGD 1929).

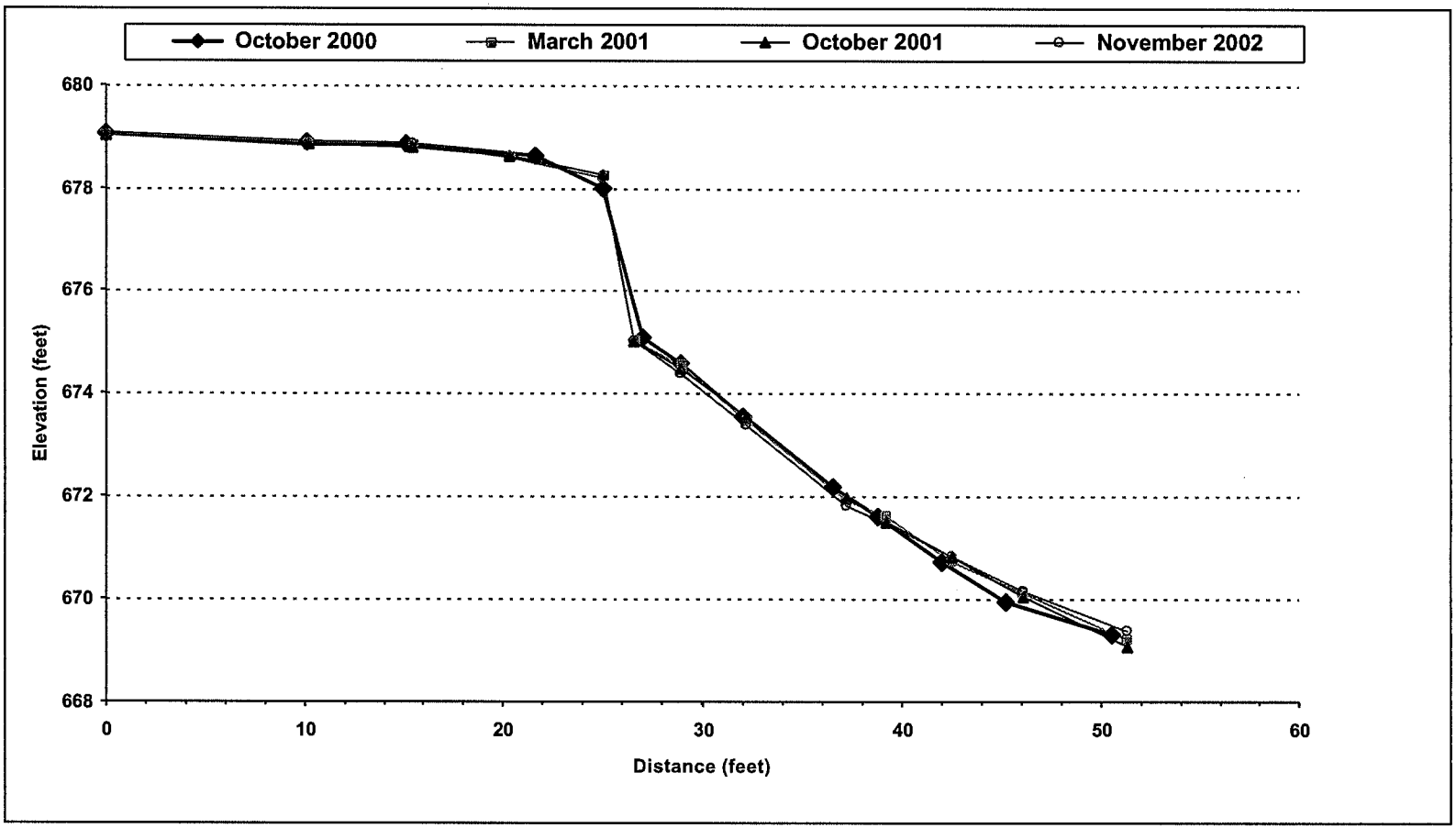
Former Otsego Impoundment - EP-89AX



Elevations are presented in feet above mean sea level (NVGD 1929).

Appendix A - 2000, 2001 and 2002 Erosion Pin Profiles

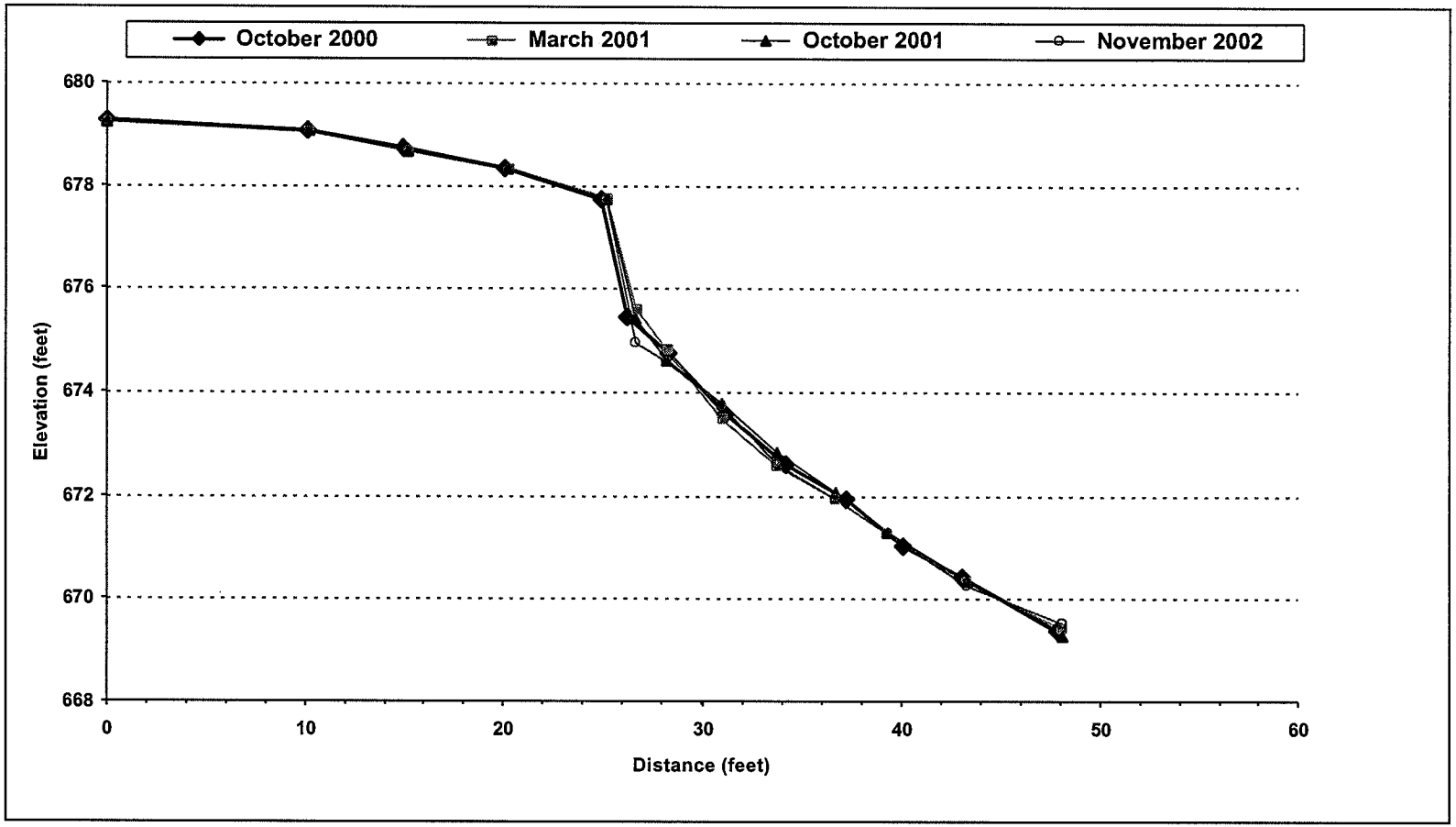
Former Otsego Impoundment - EP-89AY



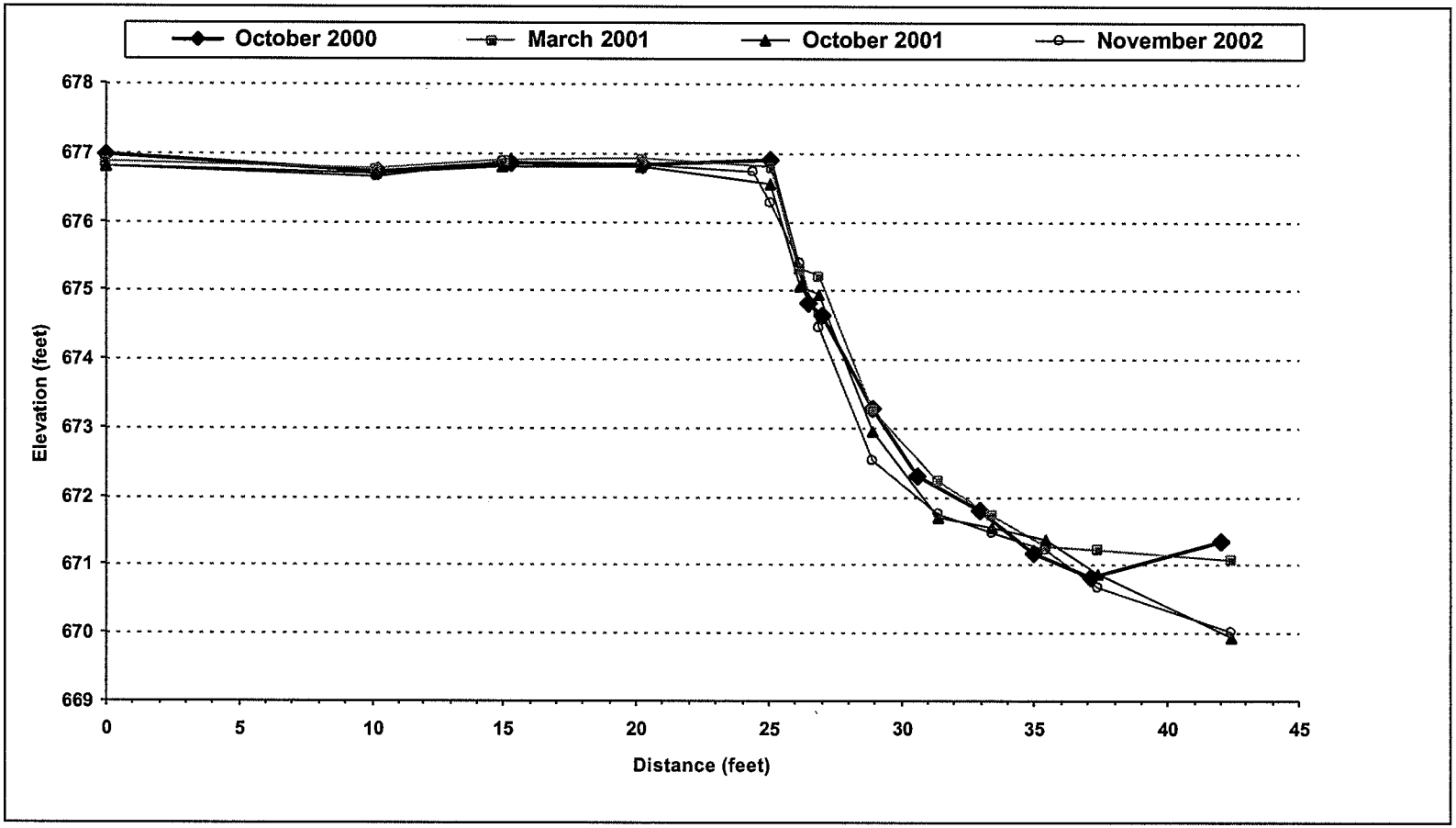
Elevations are presented in feet above mean sea level (NVGD 1929).

Appendix A - 2000, 2001 and 2002 Erosion Pin Profiles

Former Otsego Impoundment - EP-89AZ

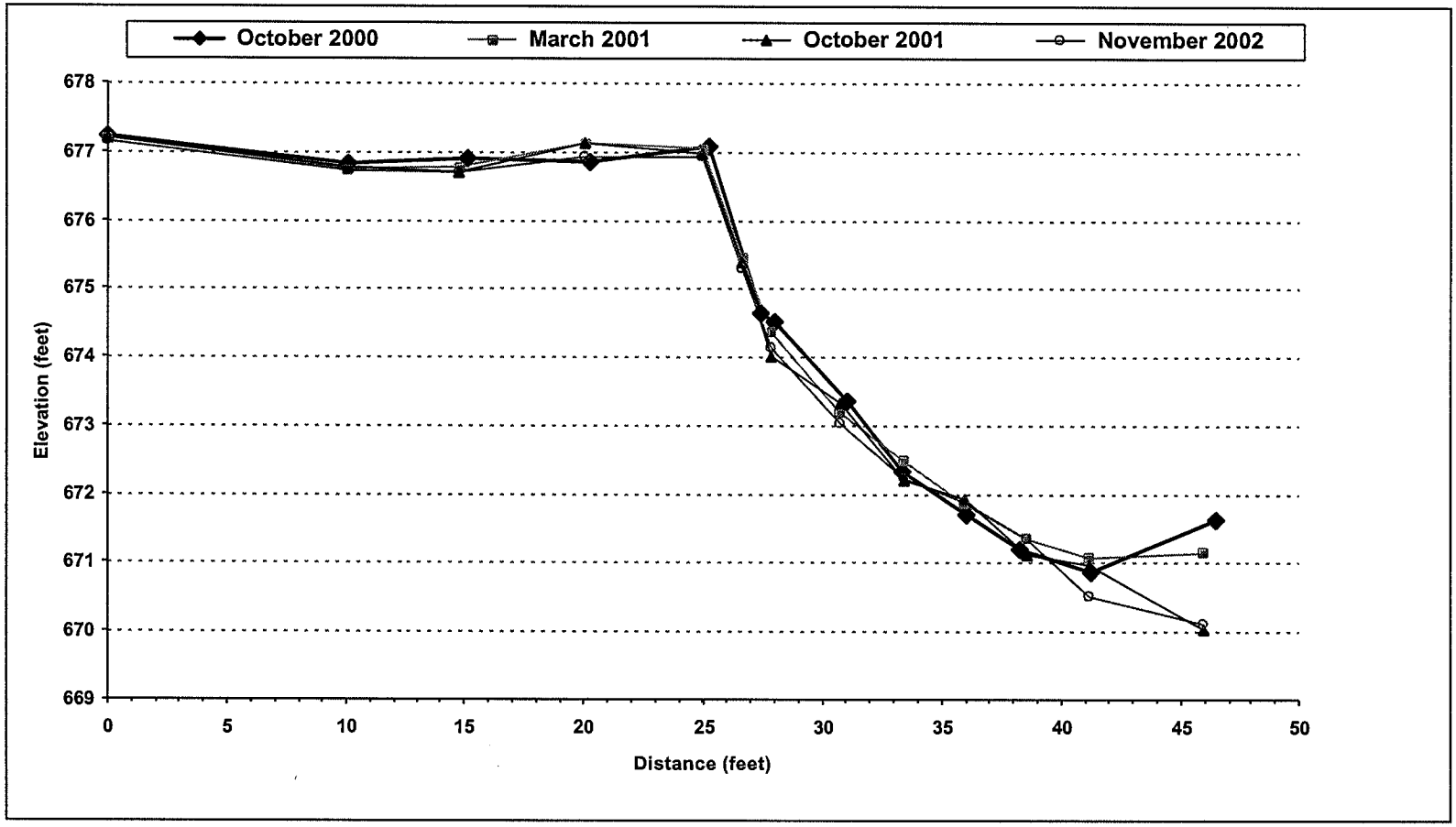


Former Otsego Impoundment - EP-89BX



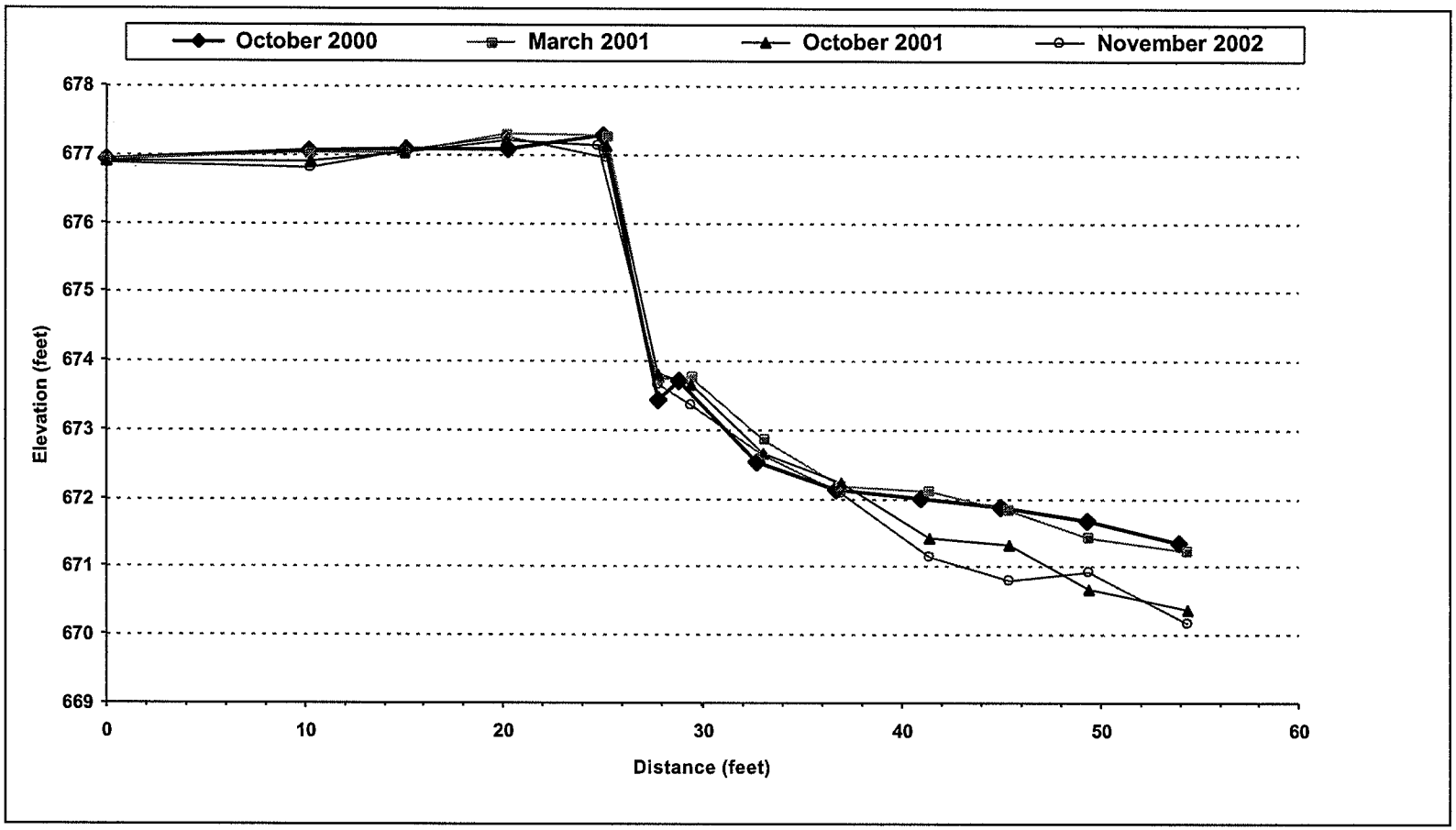
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-89BY



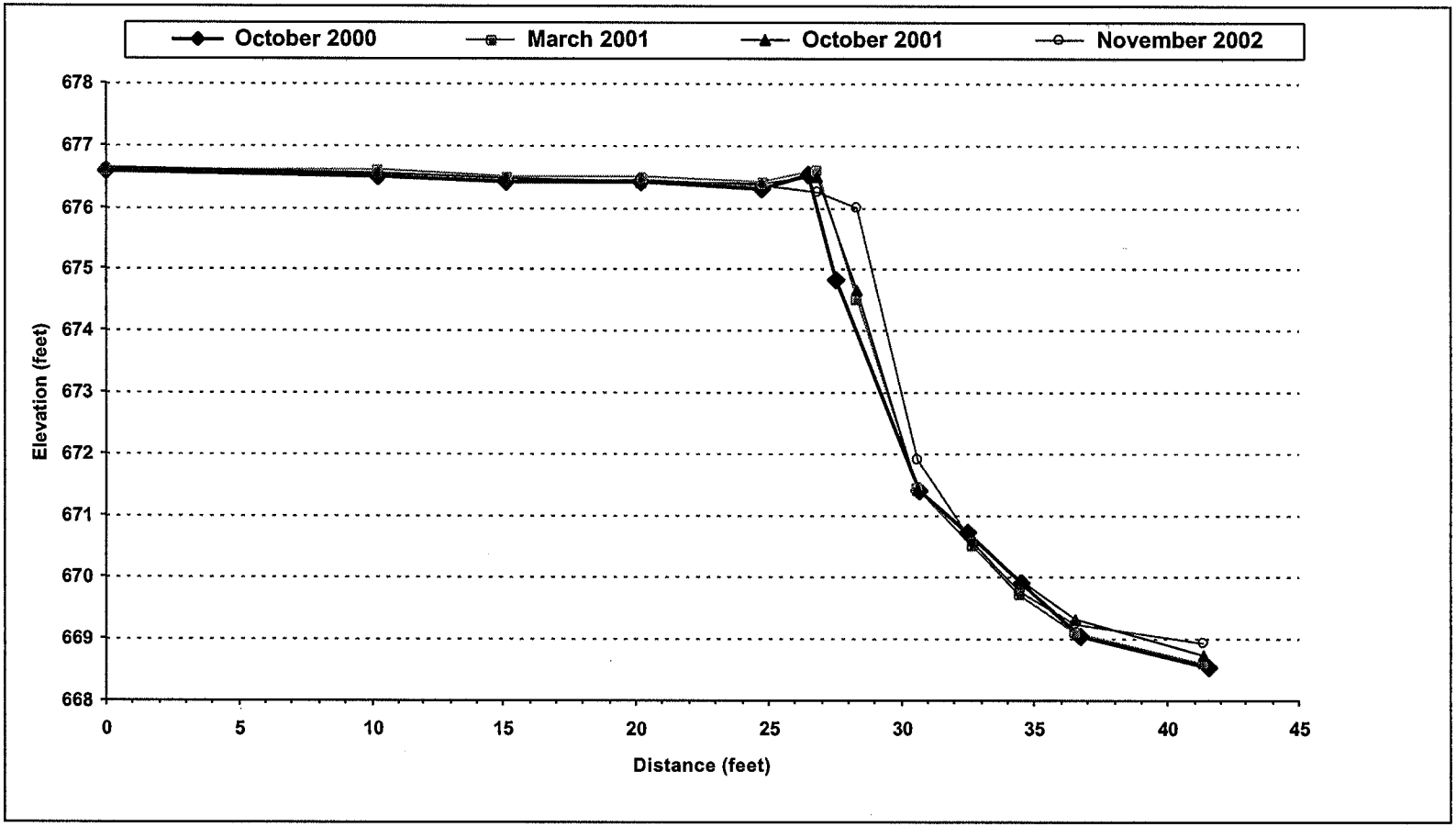
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-89BZ



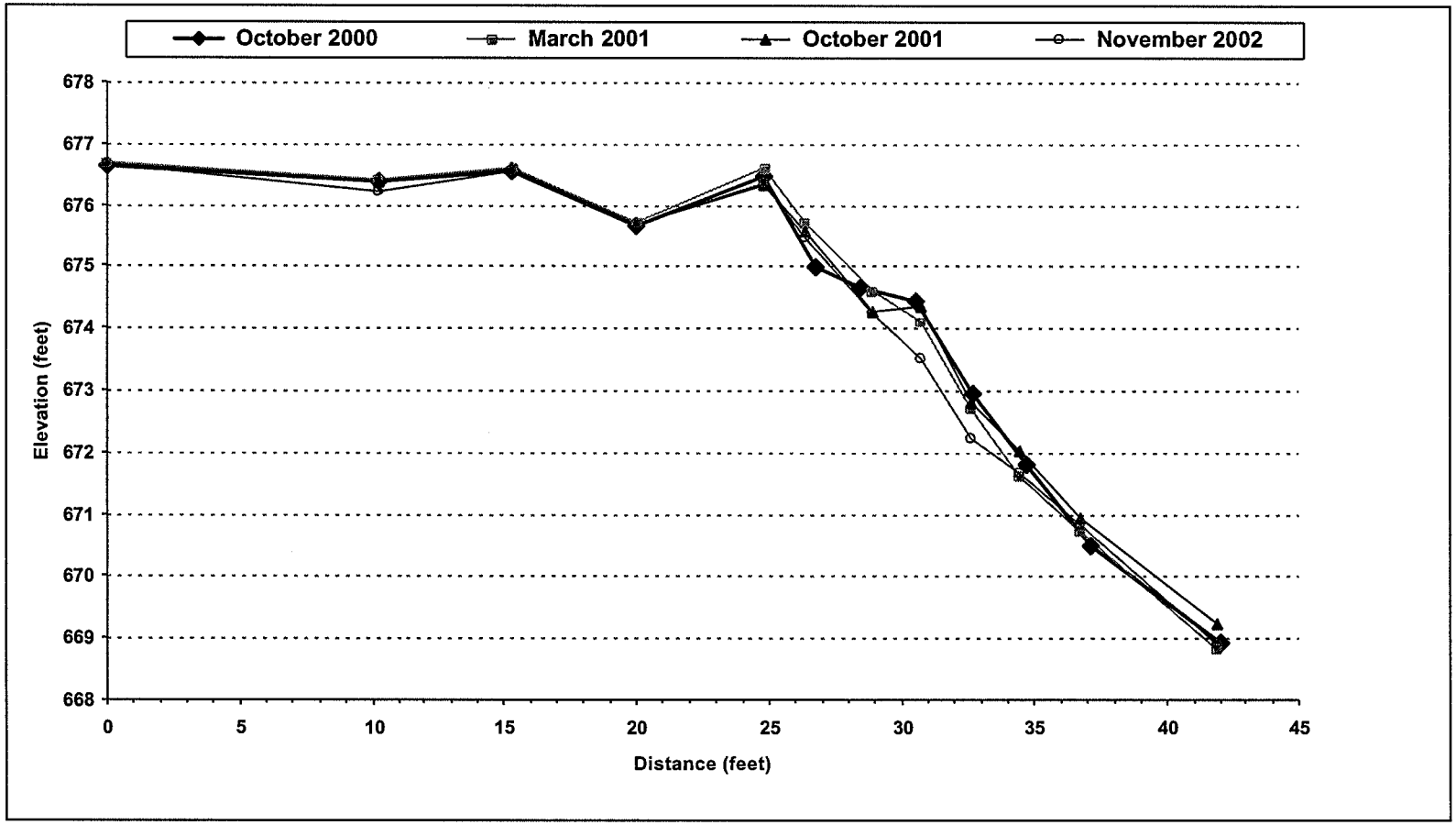
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-90AX

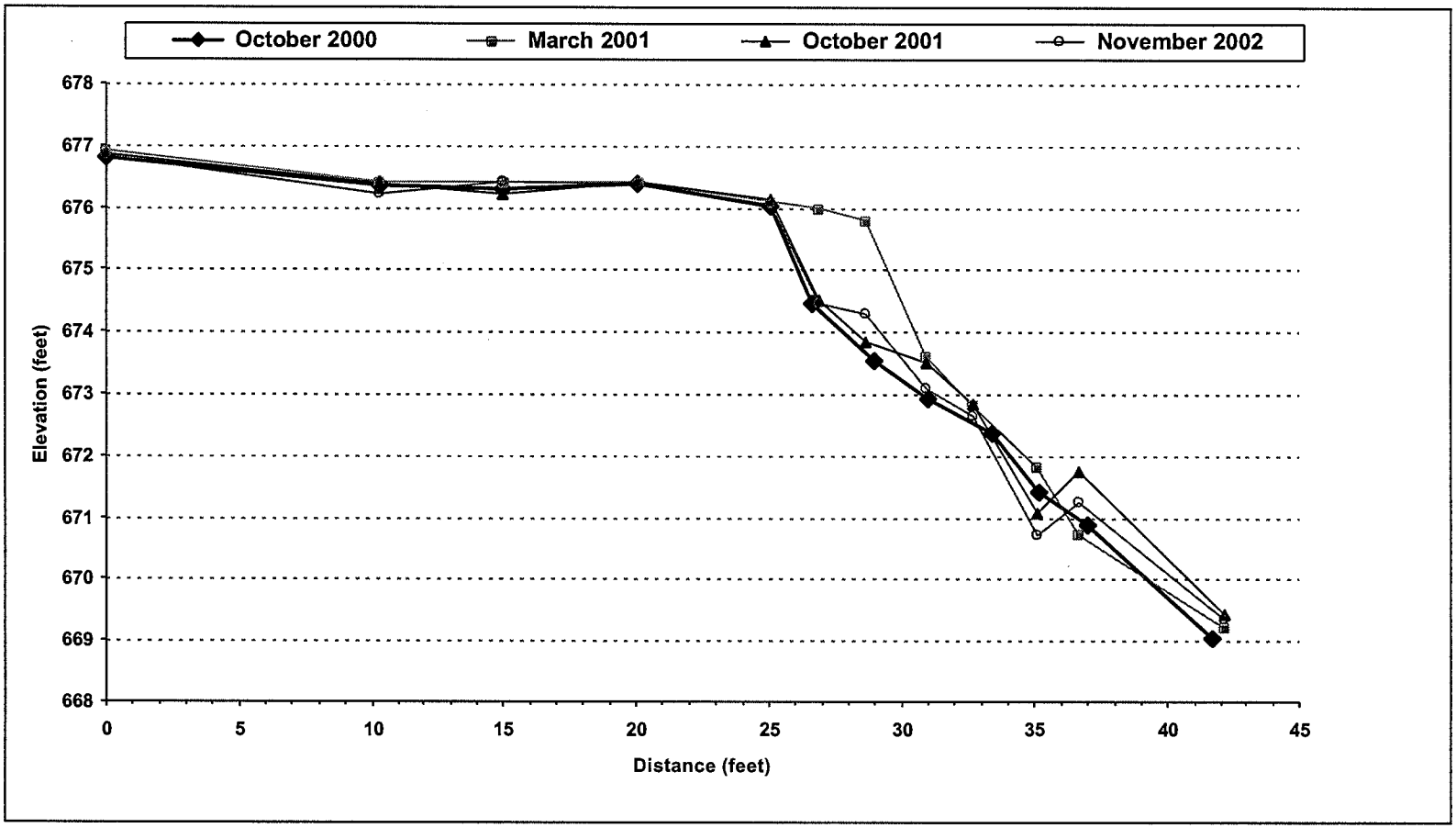


Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-90AY



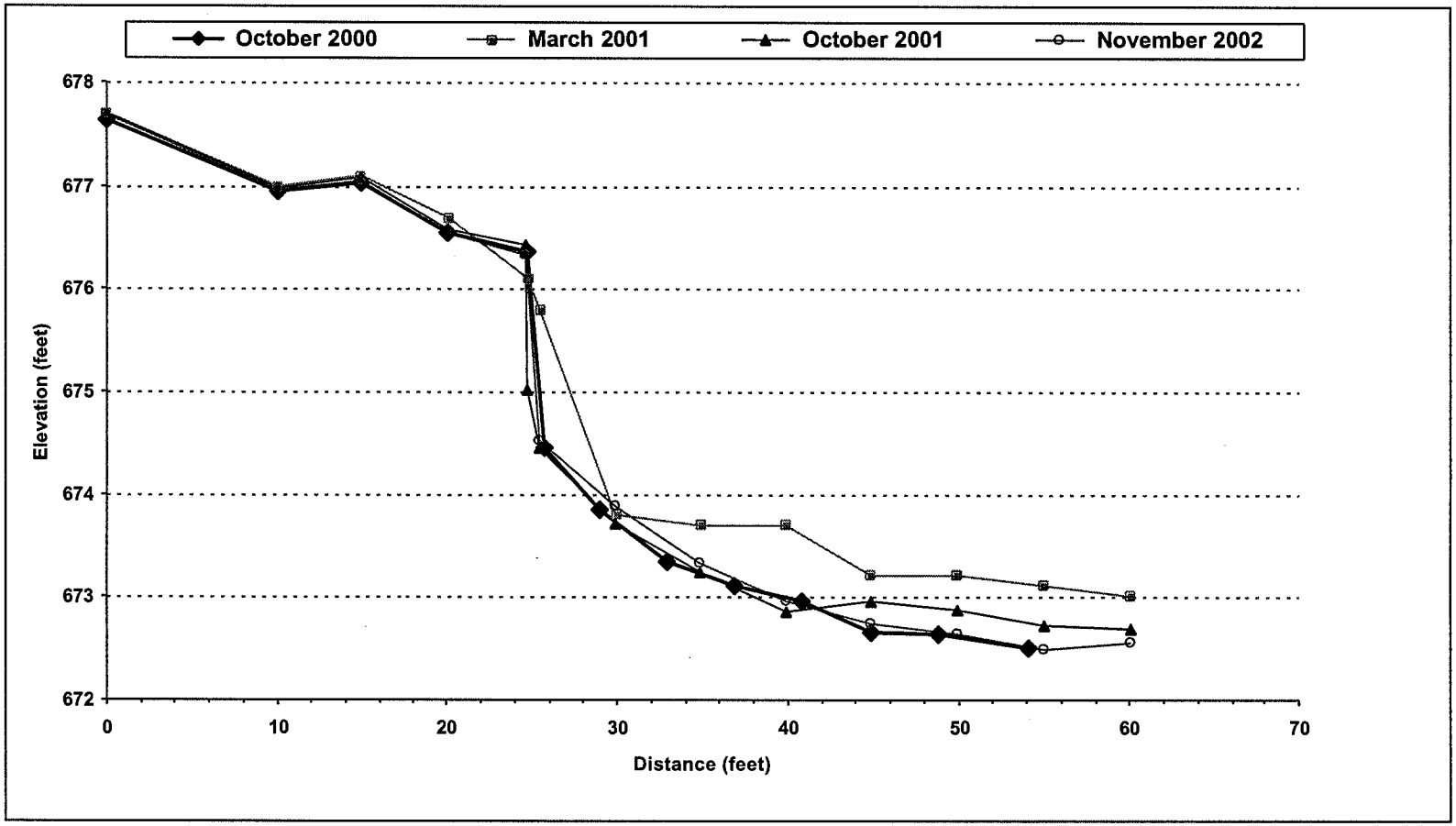
Former Otsego Impoundment - EP-90AZ



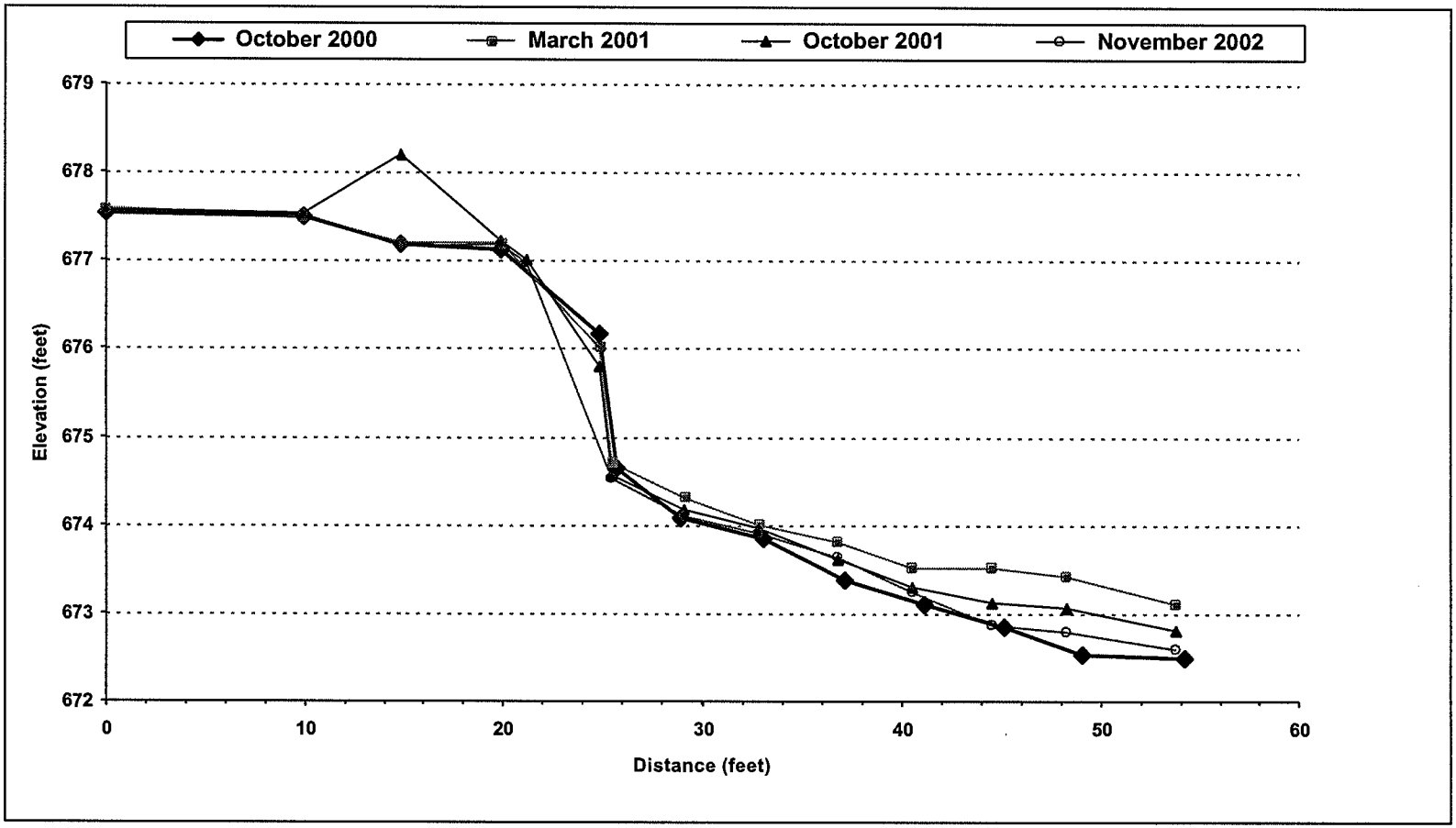
Elevations are presented in feet above mean sea level (NVGD 1929).

Appendix A - 2000, 2001 and 2002 Erosion Pin Profiles

Former Otsego Impoundment - EP-90BX

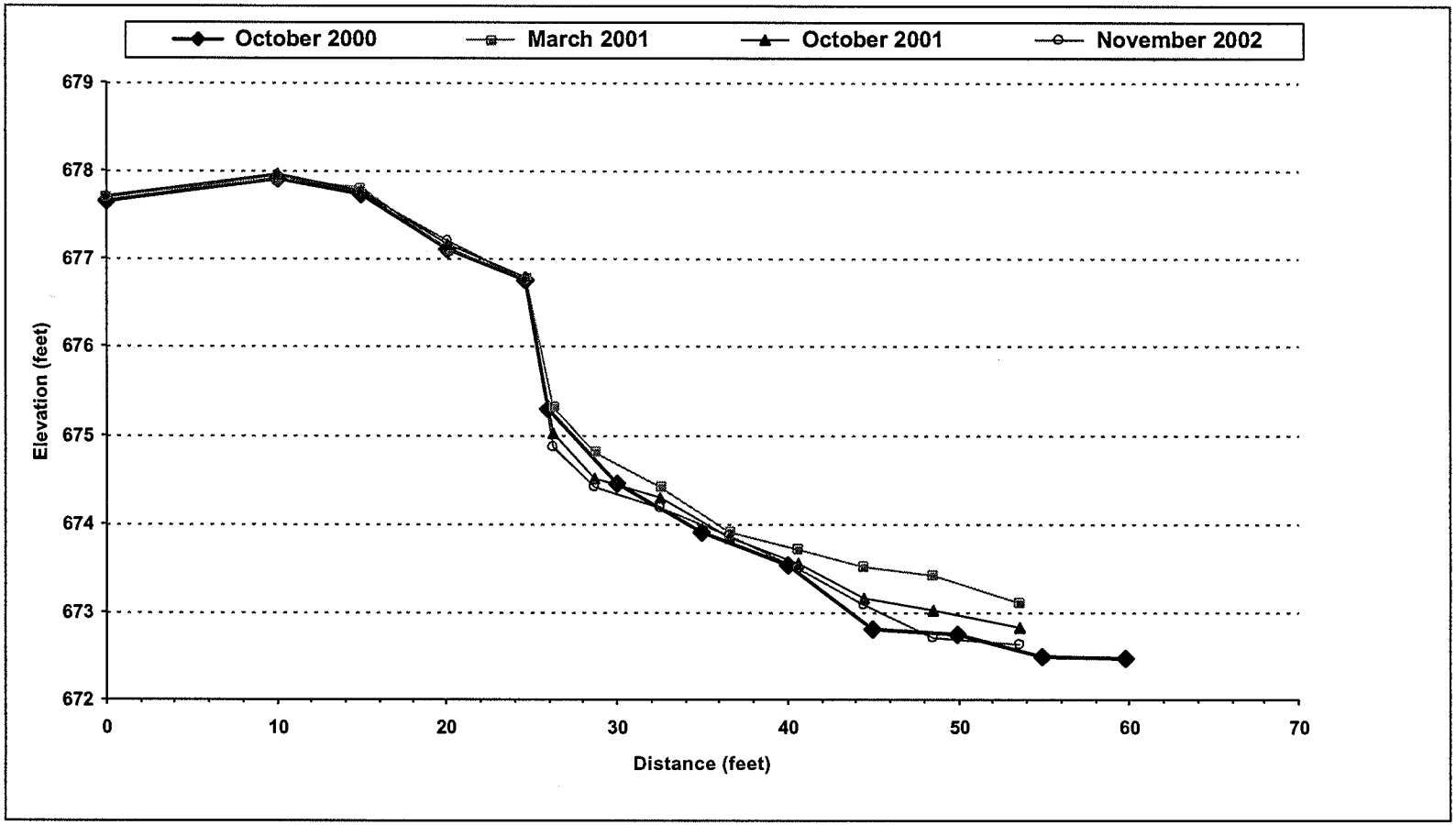


Former Otsego Impoundment - EP-90BY



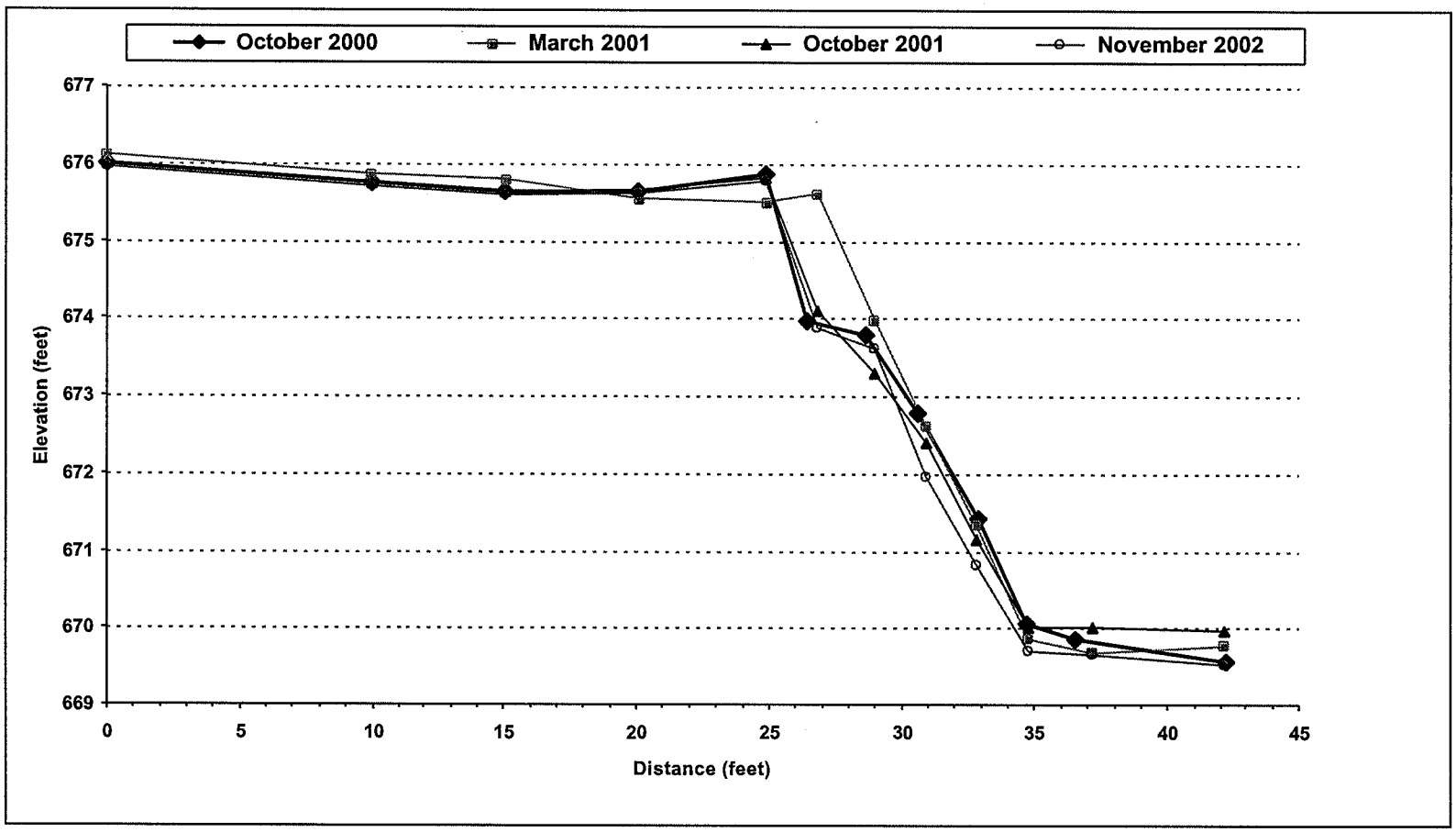
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-90BZ



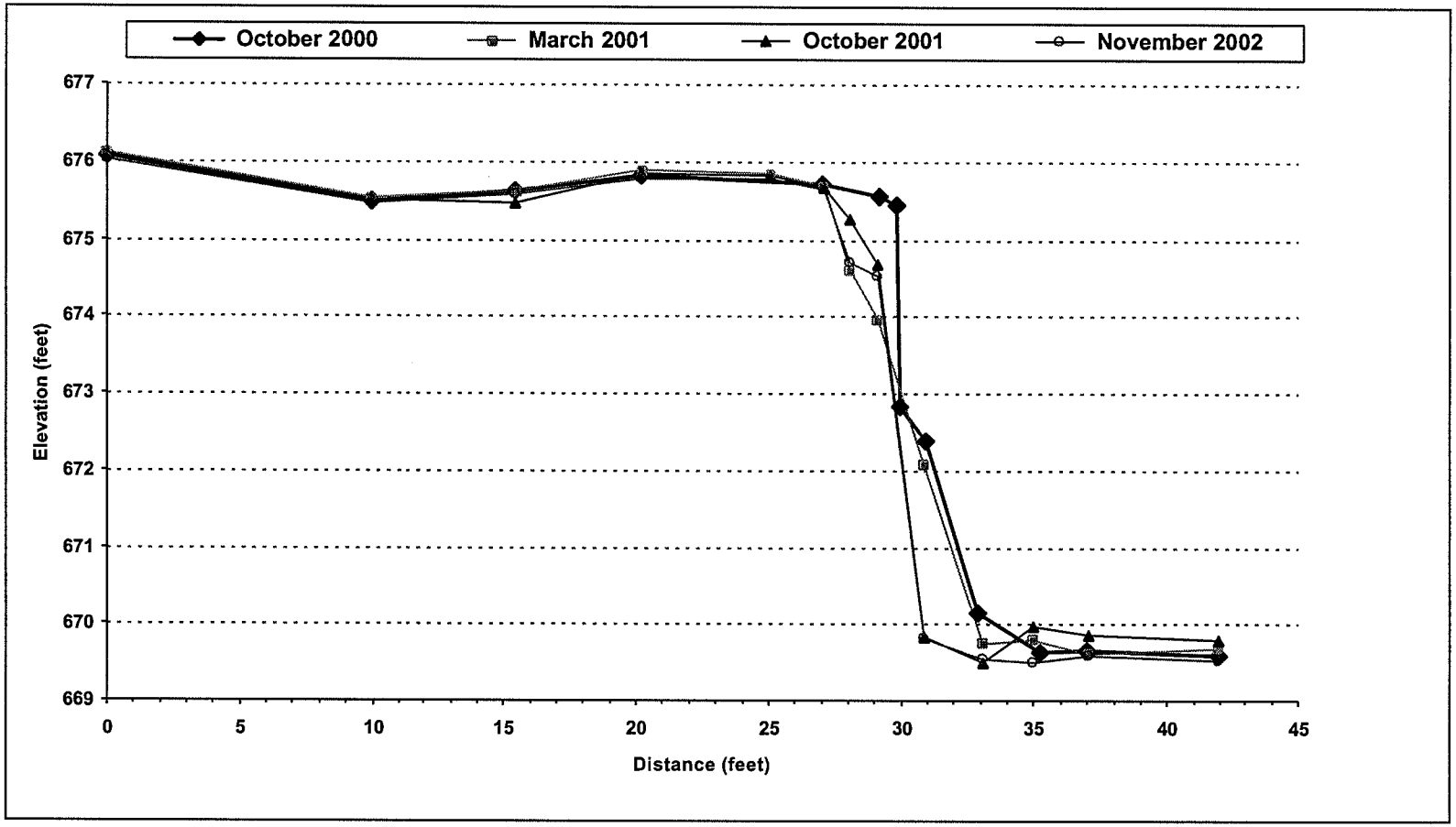
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-94AX



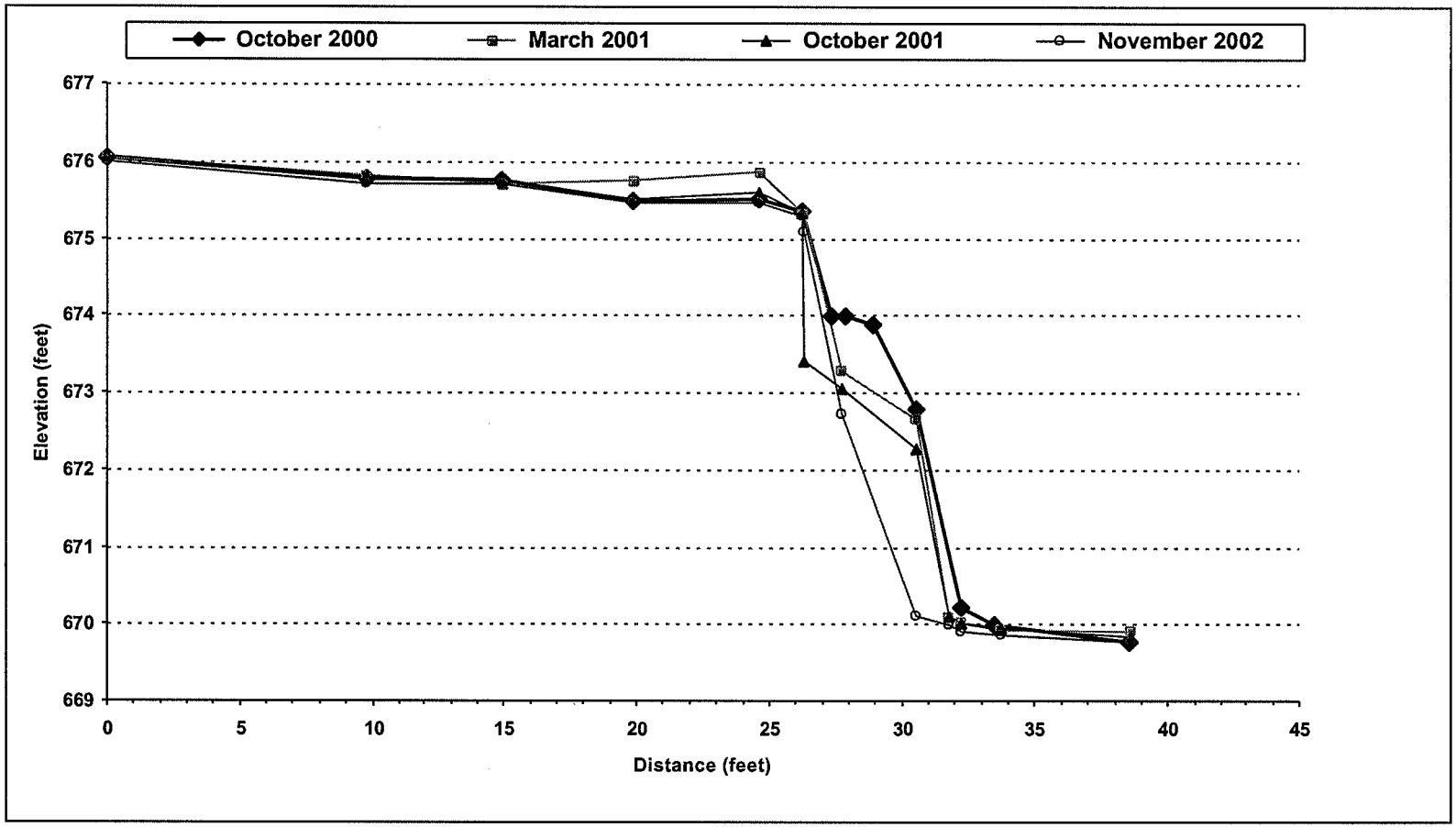
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-94AY



Elevations are presented in feet above mean sea level (NVGD 1929).

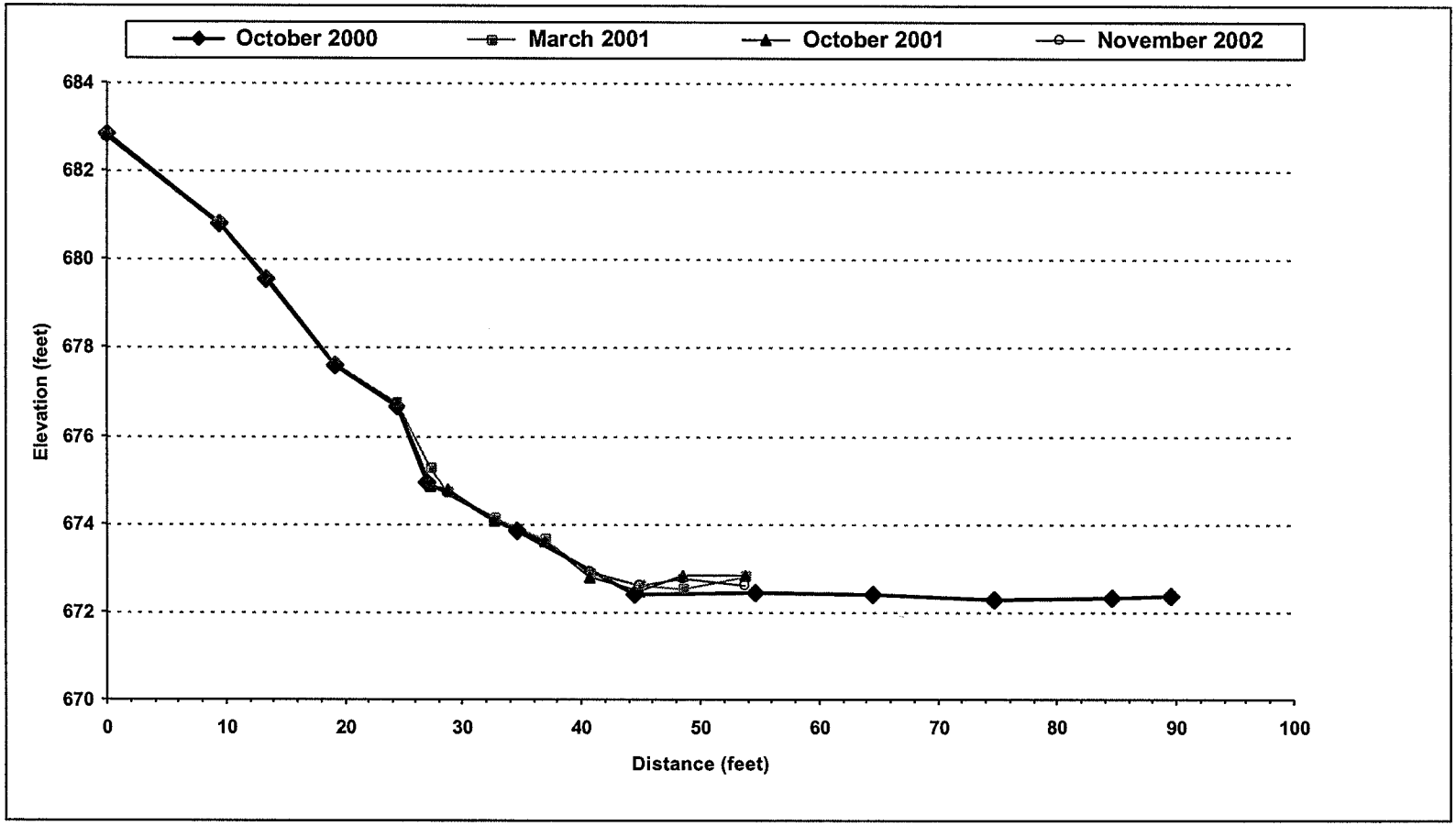
Former Otsego Impoundment - EP-94AZ



Elevations are presented in feet above mean sea level (NVGD 1929).

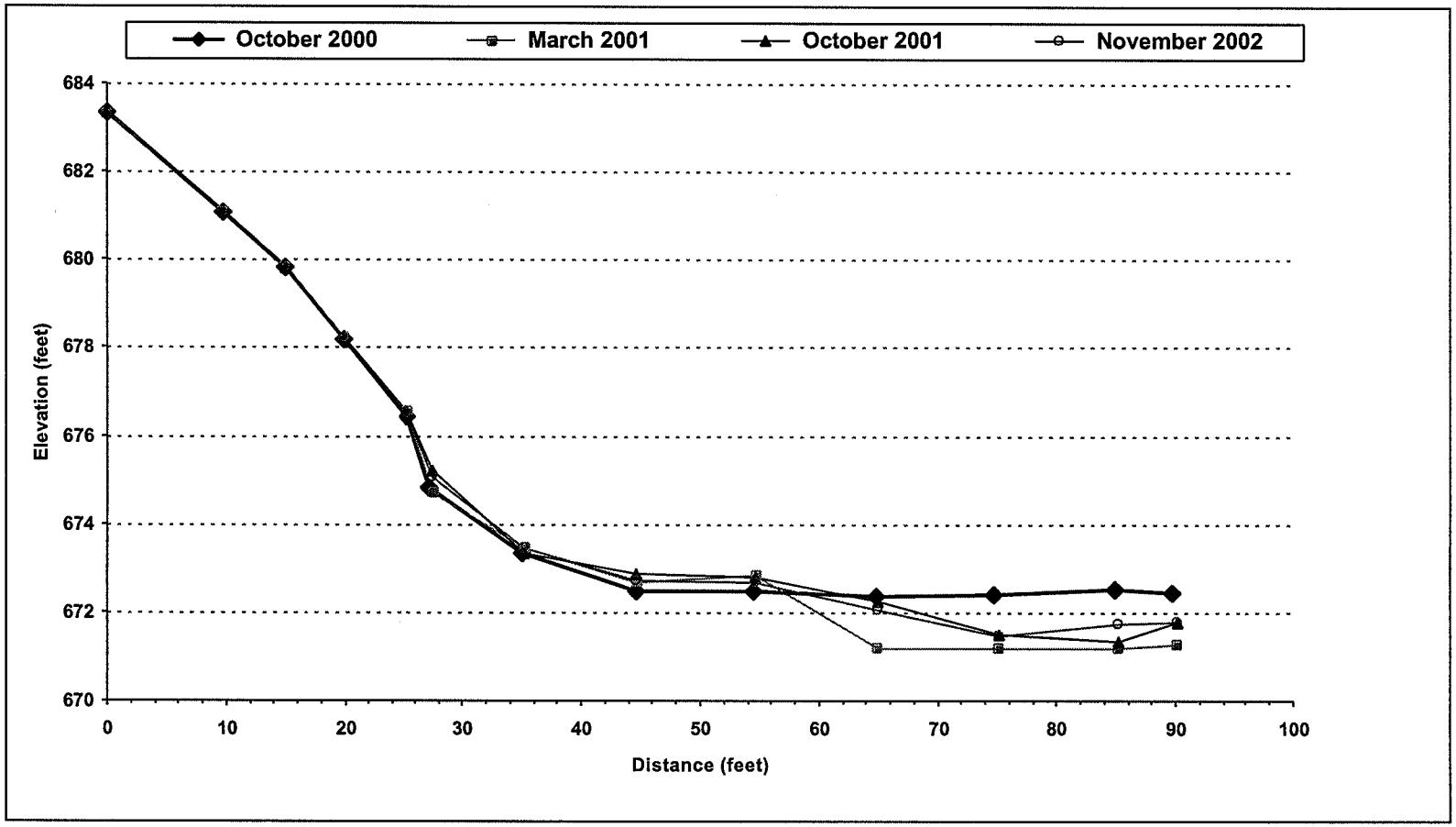
Appendix A - 2000, 2001 and 2002 Erosion Pin Profiles

Former Otsego Impoundment - EP-94BX



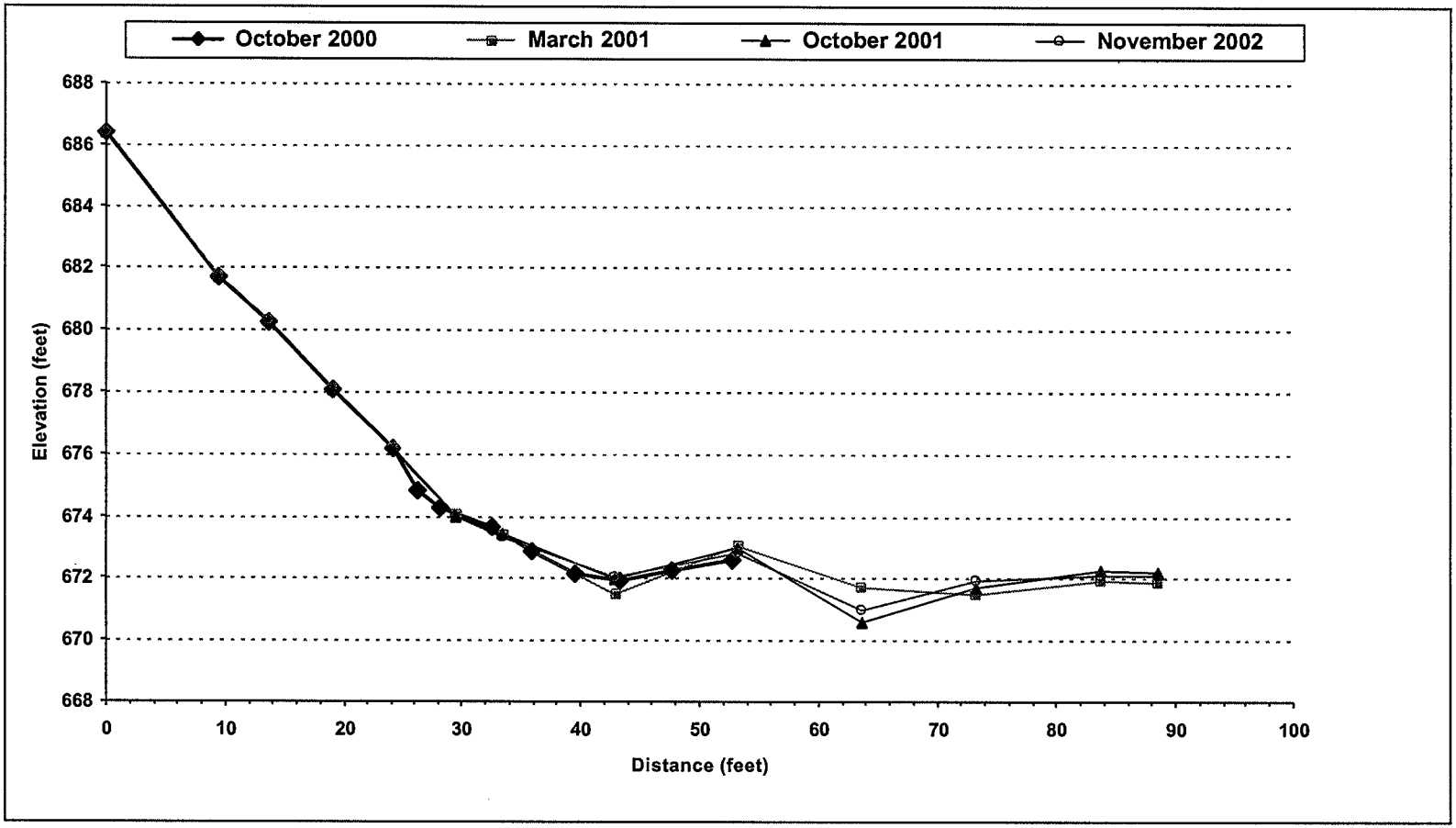
Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-94BY



Elevations are presented in feet above mean sea level (NVGD 1929).

Former Otsego Impoundment - EP-94BZ



Elevations are presented in feet above mean sea level (NVGD 1929).

Appendix B

Bank Profiles Survey Data

BBL®
BLASLAND, BOUCK & LEE, INC.
engineers & scientists

APPENDIX B

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000-2002
SURVEY DATA

Impoundment*	Transect	Location Number	October 2000		March 2001 (2001A)		October 2001 (2001B)		November 2002	
			Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)
	067AZ	9	25.05	708.10	25.05	707.70	25.05	707.63	25.05	707.72
	067AZ	10	19.86	708.30	19.86	708.20	19.86	708.18	19.86	708.13
	067AZ	11	14.77	708.00	14.77	707.80	14.77	707.87	14.77	707.85
	067AZ	12	9.77	708.20	9.77	708.10	9.77	708.10	9.77	708.00
	067AZ	13	0.00	708.50	0.00	708.40	0.00	708.39	0.00	708.34
	067BX	1	0.00	708.00	0.00	707.90	0.00	707.88	0.00	707.93
	067BX	2	10.12	707.80	10.12	707.70	10.12	707.68	10.12	707.71
	067BX	3	15.10	707.80	15.10	707.70	15.10	707.67	15.10	707.72
	067BX	4	20.21	708.00	20.21	708.00	20.21	707.90	20.21	707.97
	067BX	5	24.83	708.10	24.83	708.00	24.83	707.07	24.83	706.47
	067BX	5.5	NA**	NA**	NA**	NA**	24.70	708.15	24.70	708.14
	067BX	6	25.99	706.30	25.85	707.00	25.85	706.84	25.85	706.32
	067BX	7	28.71	705.80	27.82	706.00	27.82	706.04	27.82	705.74
	067BX	8	32.66	705.30	30.53	705.10	30.53	705.54	30.53	705.44
	067BX	9	36.71	705.30	33.47	704.40	33.47	704.85	33.47	705.06
	067BX	10	40.63	704.00	36.90	704.50	36.90	704.48	36.90	704.68
	067BX	11	44.54	703.60	39.80	704.20	39.80	704.16	39.80	704.23
	067BX	12	48.75	703.20	42.75	703.80	42.75	703.95	42.75	701.75
	067BX	13	54.11	702.80	47.95	703.20	47.95	703.63	47.95	701.26
	067BY	1	0.00	707.80	0.00	707.80	0.00	707.66	0.00	707.69
	067BY	2	10.20	708.00	10.20	707.90	10.20	707.88	10.20	707.92
	067BY	3	15.21	708.20	15.21	708.10	15.21	708.07	15.21	708.11
	067BY	4	20.08	708.60	20.08	708.60	20.08	708.55	20.08	708.58
	067BY	5	25.00	708.30	25.00	707.50	25.00	707.14	25.00	706.47
	067BY	5.5	NA**	NA**	NA**	NA**	23.04	708.68	23.04	708.71
	067BY	6	26.34	705.90	25.10	707.00	25.10	706.61	25.10	706.29
	067BY	7	28.04	705.80	27.87	705.70	27.87	705.32	27.87	705.55
	067BY	8	31.04	705.10	30.72	704.90	30.72	705.04	30.72	705.00
	067BY	9	34.26	704.60	33.74	704.50	33.74	704.60	33.74	704.72
	067BY	10	37.03	704.10	37.53	704.10	37.53	704.30	37.53	704.26
	067BY	11	40.25	703.80	40.35	703.80	40.35	704.14	40.35	703.82
	067BY	12	42.89	703.60	43.48	703.60	43.48	703.60	43.48	703.89
	067BY	13	48.22	704.10	48.14	703.20	48.14	703.50	48.14	703.25
	067BZ	1	0.00	707.90	0.00	707.80	0.00	707.80	0.00	707.84
	067BZ	2	10.20	708.30	10.20	708.20	10.20	708.11	10.20	708.16
	067BZ	3	15.30	708.60	15.30	708.50	15.30	708.50	15.30	708.54
	067BZ	4	20.26	708.60	20.26	708.50	20.26	708.54	20.26	708.58
	067BZ	5	25.18	708.50	25.18	708.40	25.18	708.41	25.18	708.38
	067BZ	6	27.47	705.80	27.20	707.00	27.20	706.19	27.20	706.30
	067BZ	7	28.18	705.90	28.76	705.80	28.76	705.63	28.76	706.02
	067BZ	8	31.04	705.30	32.59	704.90	32.59	705.06	32.59	705.22
	067BZ	9	34.17	705.00	36.75	704.10	36.75	704.27	36.75	704.41
	067BZ	10	37.21	704.40	41.59	703.80	41.59	703.90	41.59	703.62
	067BZ	11	40.08	703.90	44.82	703.20	44.82	703.32	44.82	703.20
	067BZ	12	42.98	703.50	49.33	703.00	49.33	702.90	49.33	702.74
	067BZ	13	48.66	703.00	53.98	702.70	53.98	702.57	53.98	702.40
FOI	085AX	1	59.81	673.74	60.64	673.70	60.64	673.79	60.64	673.80
	085AX	2	55.08	673.97	55.71	673.95	55.71	673.95	55.71	673.88
	085AX	3	49.91	674.28	50.84	674.21	50.84	674.18	50.84	674.17
	085AX	4	45.01	674.79	45.52	674.73	45.52	674.88	45.52	674.79
	085AX	5	39.97	675.62	40.36	675.53	40.36	675.56	40.36	675.68
	085AX	6	35.00	676.74	35.59	677.01	35.59	676.48	35.59	676.91
	085AX	7	30.05	678.47	30.64	678.64	30.64	678.46	30.64	678.47
	085AX	8	24.81	680.07	24.81	680.10	24.81	680.10	24.81	680.10
	085AX	9	20.25	680.92	20.25	680.94	20.25	680.94	20.25	680.95
	085AX	10	15.11	681.68	15.11	681.69	15.11	681.70	15.11	681.69
	085AX	11	10.09	681.74	10.09	681.76	10.09	681.76	10.09	681.76
	085AX	12	0.00	682.27	0.00	682.28	0.00	682.20	0.00	682.25
	085AY	1	59.75	673.33	59.75	673.48	59.75	673.43	59.75	673.48
	085AY	2	54.80	673.64	54.99	673.67	54.99	673.74	54.99	673.76
	085AY	3	50.24	674.36	49.80	674.67	49.80	674.56	49.80	674.72
	085AY	4	44.95	675.41	44.85	675.17	44.85	675.14	44.85	675.39
	085AY	5	39.98	676.74	40.07	676.74	40.07	676.97	40.07	676.89

APPENDIX B

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000-2002
SURVEY DATA

Impoundment*	Transect	Location Number	October 2000		March 2001 (2001A)		October 2001 (2001B)		November 2002	
			Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)
	085AY	6	35.10	677.80	35.10	678.28	35.10	678.01	35.10	677.95
	085AY	7	30.03	679.05	30.13	679.19	30.13	679.16	30.13	679.11
	085AY	8	25.18	680.54	25.18	680.58	25.18	680.58	25.18	680.57
	085AY	9	19.97	681.17	19.97	681.21	19.97	681.06	19.97	681.20
	085AY	10	14.82	681.87	14.82	681.83	14.82	681.84	14.82	681.84
	085AY	11	9.95	682.42	9.95	682.41	9.95	682.41	9.95	682.41
	085AY	12	0.00	682.69	0.00	682.71	0.00	682.70	0.00	682.65
	085AZ	1	59.96	673.40	59.54	673.69	59.54	673.48	59.54	673.42
	085AZ	2	54.77	674.54	54.72	674.51	54.72	674.55	54.72	674.43
	085AZ	3	50.01	675.46	49.80	675.58	49.80	675.70	49.80	675.67
	085AZ	4	44.87	676.06	44.75	676.18	44.75	676.26	44.75	676.30
	085AZ	5	39.90	676.72	39.80	676.62	39.80	676.63	39.80	676.65
	085AZ	6	34.91	677.28	34.83	677.22	34.83	677.23	34.83	677.31
	085AZ	7	29.81	678.17	29.88	678.12	29.88	678.23	29.88	678.21
	085AZ	8	24.86	679.40	24.86	679.43	24.86	679.41	24.86	679.43
	085AZ	9	20.11	680.50	20.11	680.54	20.11	680.52	20.11	680.48
	085AZ	10	15.26	681.92	15.26	681.86	15.26	681.94	15.26	681.93
	085AZ	11	10.19	682.23	10.19	682.24	10.19	682.24	10.19	682.24
	085AZ	12	0.00	682.70	0.00	682.71	0.00	682.69	0.00	682.69
	085BX	1	0.00	695.17	0.00	695.05	0.00	695.21	0.00	695.16
	085BX	2	7.38	689.31	7.38	689.40	7.38	689.37	7.38	689.34
	085BX	3	10.09	685.70	10.09	685.71	10.09	685.65	10.09	685.72
	085BX	4	14.33	683.08	14.33	683.14	14.33	683.09	14.33	683.09
	085BX	5	19.02	681.06	19.02	681.09	19.02	681.06	19.02	680.95
	085BX	6	20.47	678.17	20.46	678.22	20.46	678.36	20.46	678.38
	085BX	7	22.90	677.53	22.14	677.77	22.14	677.85	22.14	677.97
	085BX	8	24.91	676.75	24.20	677.00	24.20	676.94	24.20	677.18
	085BX	9	26.73	675.87	25.97	676.19	25.97	676.27	25.97	676.67
	085BX	10	28.77	675.08	27.81	675.52	27.81	675.53	27.81	675.43
	085BX	11	30.49	674.47	30.28	674.71	30.28	674.52	30.28	674.69
	085BX	12	35.56	673.15	35.06	673.12	35.06	673.20	35.06	673.21
	085BY	1	0.00	696.59	0.00	696.67	0.00	696.70	0.00	696.69
	085BY	2	8.90	690.81	8.90	690.85	8.90	690.86	8.90	690.82
	085BY	3	14.00	685.23	14.00	685.31	14.00	685.09	14.00	685.27
	085BY	4	17.80	682.45	17.80	682.46	17.80	682.31	17.80	682.43
	085BY	5	22.05	680.36	22.05	680.39	22.05	680.34	22.05	680.35
	085BY	6	22.78	678.20	22.78	678.41	22.78	678.31	22.78	678.36
	085BY	7	23.82	678.21	23.72	678.23	23.72	678.21	23.72	678.22
	085BY	8	25.88	677.54	25.88	677.64	25.88	677.63	25.88	677.55
	085BY	9	27.85	676.70	27.75	677.02	27.75	676.90	27.75	676.79
	085BY	10	29.81	675.72	29.71	676.09	29.71	676.03	29.71	676.23
	085BY	11	31.80	674.94	31.68	675.14	31.68	674.98	31.68	675.29
	085BY	12	33.77	674.33	33.23	674.34	33.23	674.47	33.23	674.48
	085BY	13	38.74	673.08	38.20	672.85	38.20	672.97	38.20	673.07
	085BZ	1	0.00	695.33	0.00	695.46	0.00	695.39	0.00	695.37
	085BZ	2	8.30	689.44	8.30	689.52	8.30	689.56	8.30	689.58
	085BZ	3	11.40	685.04	11.40	684.90	11.40	684.81	11.40	684.96
	085BZ	4	16.25	682.79	16.25	682.87	16.25	682.84	16.25	683.03
	085BZ	5	20.62	681.06	20.62	681.11	20.62	681.08	20.62	680.90
	085BZ	6	22.58	678.07	22.62	678.16	22.62	678.15	22.62	678.22
	085BZ	7	24.55	677.53	24.73	677.64	24.73	677.67	24.73	677.64
	085BZ	8	26.51	676.97	26.47	677.12	26.47	677.10	26.47	677.14
	085BZ	9	28.38	676.05	28.37	676.17	28.37	676.18	28.37	676.30
	085BZ	10	30.25	675.51	30.58	675.79	30.58	675.78	30.58	675.74
	085BZ	11	32.21	675.41	32.45	674.77	32.45	674.54	32.45	674.50
	085BZ	12	37.19	673.17	38.30	672.94	38.30	673.17	38.30	672.89
	087AX	1	77.84	672.02	78.02	672.19	78.02	672.18	78.02	672.25
	087AX	2	72.82	672.25	73.01	672.27	73.01	672.20	73.01	672.38
	087AX	3	64.94	673.81	65.24	673.68	65.24	673.30	65.24	673.28
	087AX	4	57.04	674.72	57.28	675.05	57.28	674.77	57.28	674.61
	087AX	5	51.00	675.20	51.32	675.42	51.32	675.47	51.32	675.21
	087AX	6	42.94	675.27	43.41	675.25	43.41	675.22	43.41	675.57
	087AX	7	32.78	674.63	33.44	674.51	33.44	674.46	33.44	674.36

APPENDIX B

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000-2002
SURVEY DATA

		Location	October 2000		March 2001 (2001A)		October 2001 (2001B)		November 2002	
Impoundment*	Transect	Number	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)
	087AX	8	28.49	675.77	28.18	675.86	28.18	675.66	28.18	675.47
	087AX	9	24.72	677.98	24.72	678.01	24.72	677.98	24.72	677.56
	087AX	10	19.97	678.07	19.97	678.09	19.97	678.08	19.97	677.91
	087AX	11	15.20	678.13	15.20	678.17	15.20	678.13	15.20	678.13
	087AX	12	9.99	678.23	9.99	678.25	9.99	678.22	9.99	678.14
	087AX	13	0.00	678.34	0.00	678.37	0.00	678.33	0.00	678.30
	087AY	1	72.45	672.46	72.42	672.18	72.42	672.13	72.42	672.34
	087AY	2	67.37	672.46	67.04	672.36	67.04	672.35	67.04	672.39
	087AY	3	60.55	672.87	60.50	672.72	60.50	672.45	60.50	672.90
	087AY	4	53.50	673.99	53.56	673.83	53.56	673.65	53.56	673.74
	087AY	5	46.40	674.55	46.60	674.69	46.60	674.58	46.60	674.53
	087AY	6	39.43	674.99	39.81	674.85	39.81	675.05	39.81	674.84
	087AY	7	32.52	674.68	32.73	674.71	32.73	675.10	32.73	674.82
	087AY	8	28.03	675.48	27.64	675.94	27.64	675.35	27.64	675.17
	087AY	9	25.28	678.15	25.28	678.18	25.28	678.04	25.28	677.89
	087AY	9.5	NA**	NA**	NA**	NA**	NA**	NA**	24.34	678.19
	087AY	10	20.34	678.60	20.34	678.57	20.34	678.55	20.34	678.55
	087AY	11	15.32	678.72	15.32	678.74	15.32	678.72	15.32	678.73
	087AY	12	10.10	678.76	10.10	678.79	10.10	678.76	10.10	678.78
	087AY	13	0.00	678.61	0.00	678.63	0.00	678.53	0.00	678.45
	087AZ	1	71.66	671.59	71.88	671.59	71.88	671.59	71.88	671.65
	087AZ	2	66.67	671.81	66.94	671.80	66.94	672.39	66.94	671.80
	087AZ	3	59.67	672.18	60.05	672.08	60.05	672.37	60.05	672.34
	087AZ	4	52.78	672.56	52.57	672.58	52.57	672.61	52.57	672.71
	087AZ	5	45.75	672.87	45.38	672.81	45.38	672.82	45.38	673.12
	087AZ	6	38.84	673.33	38.82	673.43	38.82	673.46	38.82	673.58
	087AZ	7	31.71	673.81	31.84	673.60	31.84	673.47	31.84	673.83
	087AZ	8	25.72	674.58	26.16	674.70	26.16	674.73	26.16	674.43
	087AZ	9	24.58	677.60	24.58	677.60	24.58	676.66	24.58	675.04
	087AZ	9.5	NA**	NA**	NA**	NA**	23.80	677.58	23.80	677.47
	087AZ	10	19.72	677.85	19.72	677.87	19.72	677.87	19.72	677.86
	087AZ	11	14.87	678.38	14.87	678.40	14.87	678.38	14.87	678.34
	087AZ	12	9.90	678.89	9.90	678.91	9.90	678.89	9.90	678.91
	087AZ	13	0.00	679.31	0.00	679.36	0.00	679.34	0.00	679.36
	087BX	1	0.00	678.29	0.00	679.08	0.00	678.31	0.00	678.31
	087BX	2	10.42	678.42	10.42	678.23	10.42	678.44	10.42	678.44
	087BX	3	14.95	678.21	14.95	678.05	14.95	678.21	14.95	678.21
	087BX	4	20.08	677.83	20.08	677.96	20.08	677.87	20.08	677.87
	087BX	5	24.85	677.59	24.85	677.77	24.85	677.59	24.85	677.45
	087BX	5.5	NA**	NA**	NA**	NA**	NA**	NA**	24.27	677.61
	087BX	6	27.51	674.96	27.66	674.80	27.66	674.89	27.66	674.68
	087BX	7	32.42	674.11	31.73	674.08	31.73	674.07	31.73	673.67
	087BX	8	39.44	673.51	38.61	673.62	38.61	673.48	38.61	673.66
	087BX	9	46.40	673.49	45.63	673.59	45.63	673.62	45.63	673.58
	087BX	10	53.37	673.35	52.70	673.47	52.70	673.54	52.70	673.62
	087BX	11	60.38	673.41	60.07	673.44	60.07	673.53	60.07	673.54
	087BX	12	67.45	673.03	66.67	672.90	66.67	673.00	66.67	673.02
	087BX	13	72.39	672.99	71.53	673.09	71.53	673.10	71.53	673.12
	087BY	1	0.00	678.59	0.00	678.60	0.00	678.59	0.00	678.59
	087BY	2	10.60	677.99	10.60	678.03	10.60	678.01	10.60	677.97
	087BY	3	15.09	677.89	15.09	677.90	15.09	677.91	15.09	677.89
	087BY	4	20.17	677.97	20.17	677.86	20.17	677.87	20.17	677.85
	087BY	5	25.11	677.87	25.11	677.87	25.11	677.74	25.11	677.61
	087BY	6	30.19	675.11	27.12	676.44	27.12	676.02	27.12	675.91
	087BY	7	32.52	674.62	32.74	674.16	32.74	674.04	32.74	673.50
	087BY	8	39.35	673.46	39.57	673.65	39.57	673.42	39.57	673.52
	087BY	9	46.45	673.58	46.67	673.70	46.67	673.51	46.67	673.50
	087BY	10	53.28	673.19	53.36	673.26	53.36	673.27	53.36	673.38
	087BY	11	60.32	673.43	60.55	673.31	60.55	673.12	60.55	673.26
	087BY	12	67.37	673.02	67.65	673.11	67.65	673.10	67.65	673.06
	087BY	13	72.23	672.85	73.31	672.98	73.31	672.91	73.31	673.00
	087BZ	1	0.00	679.06	0.00	678.31	0.00	679.07	0.00	679.07
	087BZ	2	9.49	678.14	9.49	678.44	9.49	678.21	9.49	678.20

APPENDIX B

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000-2002
SURVEY DATA

		Location	October 2000		March 2001 (2001A)		October 2001 (2001B)		November 2002	
Impoundment*	Transect	Number	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)
	087BZ	3	14.94	678.02	14.94	678.21	14.94	678.05	14.94	678.01
	087BZ	4	19.84	677.90	19.84	677.87	19.84	677.95	19.84	677.91
	087BZ	5	24.78	677.75	24.78	677.60	24.78	677.60	24.78	677.39
	087BZ	6	29.32	675.19	27.23	676.29	27.23	675.94	27.23	675.92
	087BZ	7	31.94	674.15	32.72	674.11	32.72	673.78	32.72	673.64
	087BZ	8	38.73	673.45	39.71	673.71	39.71	673.42	39.71	673.39
	087BZ	9	45.86	673.33	46.60	673.29	46.60	673.34	46.60	673.25
	087BZ	10	52.77	673.13	53.62	673.08	53.62	673.14	53.62	673.04
	087BZ	11	59.84	673.20	60.59	673.11	60.59	673.17	60.59	673.27
	087BZ	12	66.90	673.27	67.94	673.06	67.94	673.10	67.94	673.21
	087BZ	13	71.53	673.02	72.80	673.12	72.80	672.94	72.80	673.13
	089AX	1	48.11	669.52	48.00	669.46	48.00	669.17	48.00	669.59
	089AX	2	42.58	670.34	43.03	670.35	43.03	670.38	43.03	670.29
	089AX	3	39.83	671.15	39.73	670.95	39.73	671.14	39.73	671.06
	089AX	4	36.58	671.95	36.93	671.74	36.93	671.84	36.93	671.88
	089AX	5	33.61	673.23	33.83	673.23	33.83	671.99	33.83	673.15
	089AX	6	31.13	673.99	30.79	674.03	30.79	673.28	30.79	674.10
	089AX	7	27.88	674.84	27.97	675.34	27.97	674.30	27.97	675.11
	089AX	8	24.87	678.40	24.75	678.44	24.75	678.39	24.75	678.37
	089AX	9	19.95	678.78	20.22	678.81	20.22	678.79	20.22	678.76
	089AX	10	15.07	678.80	15.04	678.80	15.04	678.79	15.04	678.78
	089AX	11	10.12	678.38	10.12	678.42	10.12	678.41	10.12	678.42
	089AX	12	0.00	678.36	0.00	678.39	0.00	678.36	0.00	678.37
	089AY	1	50.53	669.31	51.33	669.21	51.33	669.07	51.33	669.36
	089AY	2	45.24	669.94	46.11	670.11	46.11	670.03	46.11	670.16
	089AY	3	42.01	670.70	42.54	670.73	42.54	670.80	42.54	670.81
	089AY	4	38.83	671.59	39.27	671.58	39.27	671.50	39.27	671.46
	089AY	5	36.53	672.14	37.23	671.89	37.23	671.94	37.23	671.80
	089AY	6	32.07	673.54	32.20	673.45	32.20	673.53	32.20	673.35
	089AY	7	28.89	674.58	28.93	674.54	28.93	674.47	28.93	674.36
	089AY	8	27.00	675.06	26.60	675.02	26.60	675.02	26.60	675.02
	089AY	9	24.98	678.00	25.05	678.27	25.05	678.25	25.05	678.19
	089AY	10	21.59	678.61	20.36	678.64	20.36	678.61	20.36	678.60
	089AY	11	15.13	678.85	15.44	678.85	15.44	678.81	15.44	678.85
	089AY	12	10.09	678.88	10.12	678.90	10.12	678.85	10.12	678.84
	089AY	13	0.00	679.05	0.00	679.07	0.00	679.04	0.00	679.04
	089AZ	1	47.86	669.37	48.09	669.41	48.09	669.28	48.09	669.52
	089AZ	2	43.03	670.40	43.32	670.32	43.32	670.34	43.32	670.26
	089AZ	3	40.13	671.01	39.36	671.24	39.36	671.30	39.36	671.24
	089AZ	4	37.26	671.93	36.76	671.93	36.76	672.05	36.76	671.92
	089AZ	5	34.20	672.58	33.79	672.55	33.79	672.82	33.79	672.60
	089AZ	6	31.20	673.57	30.98	673.47	30.98	673.75	30.98	673.74
	089AZ	7	28.32	674.74	28.24	674.81	28.24	674.62	28.24	674.57
	089AZ	8	26.22	675.44	26.63	675.60	26.63	675.40	26.63	674.93
	089AZ	9	24.91	677.72	25.18	677.74	25.18	677.71	25.18	677.73
	089AZ	10	20.02	678.34	20.20	678.32	20.20	678.32	20.20	678.30
	089AZ	11	14.93	678.72	15.20	678.67	15.20	678.65	15.20	678.65
	089AZ	12	10.04	679.07	10.12	679.06	10.12	679.06	10.12	679.03
	089AZ	13	0.00	679.26	0.00	679.24	0.00	679.24	0.00	679.24
	089BX	1	0.00	676.96	0.00	676.87	0.00	676.80	0.00	676.79
	089BX	2	10.23	676.72	10.13	676.77	10.13	676.70	10.13	676.65
	089BX	3	15.27	676.84	14.96	676.89	14.96	676.79	14.96	676.86
	089BX	4	20.22	676.83	20.21	676.92	20.21	676.80	20.21	676.83
	089BX	5	25.07	676.90	25.06	676.79	25.06	676.54	25.06	676.26
	089BX	5.5	NA**	NA**	NA**	NA**	NA**	NA**	24.45	676.73
	089BX	6	26.50	674.81	26.16	675.31	26.16	675.07	26.16	675.38
	089BX	7	27.00	674.64	26.88	675.21	26.88	674.94	26.88	674.46
	089BX	8	28.91	673.27	28.94	673.26	28.94	672.94	28.94	672.51
	089BX	9	30.60	672.29	31.41	672.23	31.41	671.70	31.41	671.73
	089BX	10	32.97	671.79	33.43	671.71	33.43	671.55	33.43	671.47
	089BX	11	34.96	671.16	35.41	671.27	35.41	671.37	35.41	671.20
	089BX	12	37.11	670.80	37.41	671.22	37.41	670.87	37.41	670.65
	089BX	13	42.03	671.33	42.37	671.07	42.37	669.94	42.37	670.00

APPENDIX B

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000-2002
SURVEY DATA

Impoundment*	Transect	Location Number	October 2000		March 2001 (2001A)		October 2001 (2001B)		November 2002	
			Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)
	089BY	1	0.00	677.23	0.00	677.19	0.00	677.19	0.00	677.14
	089BY	2	10.04	676.81	10.03	676.75	10.03	676.77	10.03	676.72
	089BY	3	15.11	676.90	14.78	676.78	14.78	676.69	14.78	676.70
	089BY	4	20.24	676.85	20.06	677.12	20.06	677.11	20.06	676.93
	089BY	5	25.27	677.06	24.96	677.05	24.96	676.97	24.96	676.92
	089BY	6	27.41	674.63	26.62	675.45	26.62	675.39	26.62	675.29
	089BY	7	28.03	674.50	27.85	674.36	27.85	674.00	27.85	674.14
	089BY	8	31.04	673.36	30.78	673.18	30.78	673.32	30.78	673.02
	089BY	9	33.39	672.33	33.42	672.47	33.42	672.19	33.42	672.23
	089BY	10	36.02	671.68	35.95	671.84	35.95	671.91	35.95	671.87
	089BY	11	38.27	671.19	38.59	671.34	38.59	671.11	38.59	671.33
	089BY	12	41.27	670.87	41.14	671.06	41.14	670.95	41.14	670.50
	089BY	13	46.44	671.62	45.98	671.13	45.98	670.02	45.98	670.10
	089BZ	1	0.00	676.92	0.00	676.93	0.00	676.89	0.00	676.87
	089BZ	2	10.16	677.05	10.24	677.01	10.24	676.90	10.24	676.80
	089BZ	3	15.13	677.06	14.99	677.03	14.99	677.02	14.99	677.05
	089BZ	4	20.27	677.07	20.14	677.29	20.14	677.19	20.14	677.25
	089BZ	5	24.99	677.26	25.15	677.28	25.15	677.13	25.15	676.95
	089BZ	5.5	NA**	NA**	NA**	NA**	NA**	NA**	24.71	677.12
	089BZ	6	27.77	673.42	27.80	673.73	27.80	673.80	27.80	673.65
	089BZ	7	28.82	673.69	29.48	673.74	29.48	673.64	29.48	673.35
	089BZ	8	32.73	672.53	33.08	672.84	33.08	672.65	33.08	672.62
	089BZ	9	36.74	672.11	37.01	672.17	37.01	672.23	37.01	672.07
	089BZ	10	41.02	672.00	41.42	672.08	41.42	671.42	41.42	671.14
	089BZ	11	44.95	671.87	45.38	671.81	45.38	671.31	45.38	670.79
	089BZ	12	49.36	671.66	49.41	671.41	49.41	670.67	49.41	670.90
	089BZ	13	53.92	671.33	54.32	671.21	54.32	670.35	54.32	670.15
	090AX	1	41.57	668.52	41.37	668.60	41.37	668.72	41.37	668.91
	090AX	2	36.72	669.03	36.50	669.10	36.50	669.30	36.50	669.23
	090AX	3	34.49	669.89	34.48	669.70	34.48	669.96	34.48	669.75
	090AX	4	32.51	670.72	32.72	670.50	32.72	670.60	32.72	670.55
	090AX	5	30.67	671.37	30.59	671.40	30.59	671.40	30.59	671.89
	090AX	6	NA**	NA**	NA**	NA**	28.35	674.64	28.35	675.99
	090AX	7	27.56	674.81	28.35	674.50	NA**	NA**	NA**	NA**
	090AX	8	26.51	676.52	26.84	676.60	26.84	676.49	26.84	676.25
	090AX	9	24.73	676.31	24.73	676.40	24.73	676.37	24.73	676.34
	090AX	10	20.16	676.41	20.16	676.50	20.16	676.42	20.16	676.43
	090AX	11	15.14	676.40	15.14	676.50	15.14	676.45	15.14	676.40
	090AX	12	10.24	676.49	10.24	676.60	10.24	676.54	10.24	676.53
	090AX	13	0.00	676.58	0.00	676.60	0.00	676.62	0.00	676.61
	090AY	1	42.02	668.91	41.87	668.80	41.87	669.22	41.87	668.90
	090AY	2	37.10	670.48	36.70	670.70	36.70	670.94	36.70	670.82
	090AY	3	34.74	671.79	34.46	671.60	34.46	672.03	34.46	671.65
	090AY	4	32.68	672.95	32.65	672.70	32.65	672.81	32.65	672.23
	090AY	5	30.54	674.42	30.74	674.10	30.74	674.33	30.74	673.49
	090AY	6	28.48	674.65	28.92	674.60	28.92	674.27	28.92	674.24
	090AY	7	26.74	674.99	26.40	675.70	26.40	675.57	26.40	675.46
	090AY	8	24.84	676.47	24.84	676.60	24.84	676.33	24.84	676.35
	090AY	9	20.01	675.65	20.01	675.70	20.01	675.68	20.01	675.68
	090AY	10	15.31	676.54	15.31	676.60	15.31	676.58	15.31	676.56
	090AY	11	10.24	676.37	10.24	676.40	10.24	676.38	10.24	676.22
	090AY	12	0.00	676.64	0.00	676.70	0.00	676.66	0.00	676.65
	090AZ	1	41.68	669.02	42.14	669.20	42.14	669.42	42.14	669.33
	090AZ	2	36.99	670.89	35.12	671.80	35.12	671.07	35.12	670.71
	090AZ	3	35.20	671.42	36.68	670.70	36.68	671.73	36.68	671.25
	090AZ	4	33.43	672.35	32.66	672.80	32.66	672.82	32.66	672.64
	090AZ	5	31.02	672.91	30.92	673.60	30.92	673.49	30.92	673.08
	090AZ	6	28.97	673.54	28.65	675.80	28.65	673.84	28.65	674.28
	090AZ	7	26.64	674.44	26.89	676.00	26.89	674.51	26.89	674.45
	090AZ	8	25.08	676.03	25.08	676.10	25.08	676.13	25.08	676.05
	090AZ	9	20.06	676.37	20.06	676.40	20.06	676.42	20.06	676.39
	090AZ	10	14.96	676.31	14.96	676.40	14.96	676.22	14.96	676.40
	090AZ	11	10.28	676.34	10.28	676.40	10.28	676.39	10.28	676.20

APPENDIX B

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000-2002
SURVEY DATA

Impoundment*	Transect	Location Number	October 2000		March 2001 (2001A)		October 2001 (2001B)		November 2002	
			Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)
	090AZ	12	0.00	676.80	0.00	676.90	0.00	676.85	0.00	676.83
	090BX	1	0.00	677.63	0.00	677.70	0.00	677.69	0.00	677.68
	090BX	2	10.00	676.95	10.00	677.00	10.00	676.97	10.00	676.96
	090BX	3	14.91	677.03	14.91	677.10	14.91	677.07	14.91	677.05
	090BX	4	20.06	676.54	20.06	676.70	20.06	676.58	20.06	676.54
	090BX	5	24.69	676.35	24.69	676.10	24.69	675.01	NA**	NA**
	090BX	5.5	NA**	NA**	NA**	NA**	24.59	676.42	24.59	676.33
	090BX	6	25.77	674.44	25.42	675.80	25.42	674.44	25.42	674.51
	090BX	7	28.95	673.84	29.86	673.80	29.86	673.71	29.86	673.88
	090BX	8	32.93	673.34	34.84	673.70	34.84	673.24	34.84	673.32
	090BX	9	36.89	673.11	39.89	673.70	39.89	672.86	39.89	672.96
	090BX	10	40.85	672.96	44.93	673.20	44.93	672.96	44.93	672.74
	090BX	11	44.84	672.66	49.92	673.20	49.92	672.87	49.92	672.64
	090BX	12	48.83	672.63	55.02	673.10	55.02	672.72	55.02	672.49
	090BX	13	54.07	672.51	60.07	673.00	60.07	672.68	60.07	672.55
	090BY	1	0.00	677.54	0.00	677.60	0.00	677.58	0.00	677.56
	090BY	2	9.92	677.50	9.92	677.50	9.92	677.54	9.92	677.51
	090BY	3	14.83	677.18	14.83	677.20	14.83	678.20	14.83	677.17
	090BY	4	19.85	677.13	19.85	677.20	19.85	677.23	19.85	677.18
	090BY	5	24.85	676.17	24.85	676.00	24.85	675.79	NA**	NA**
	090BY	5.5	NA**	NA**	NA**	NA**	21.16	677.00	21.16	676.96
	090BY	6	25.70	674.64	25.48	674.70	25.48	674.57	25.48	674.52
	090BY	7	28.87	674.08	29.07	674.30	29.07	674.17	29.07	674.10
	090BY	8	33.07	673.83	32.85	674.00	32.85	673.95	32.85	673.89
	090BY	9	37.15	673.37	36.86	673.80	36.86	673.60	36.86	673.62
	090BY	10	41.15	673.09	40.52	673.50	40.52	673.30	40.52	673.23
	090BY	11	45.15	672.85	44.53	673.50	44.53	673.12	44.53	672.87
	090BY	12	49.04	672.53	48.31	673.40	48.31	673.06	48.31	672.79
	090BY	13	54.16	672.49	53.74	673.10	53.74	672.80	53.74	672.58
	090BZ	1	0.00	677.65	0.00	677.70	0.00	677.71	0.00	677.69
	090BZ	2	10.02	677.91	10.02	677.90	10.02	677.96	10.02	677.94
	090BZ	3	14.89	677.73	14.89	677.80	14.89	677.77	14.89	677.75
	090BZ	4	20.03	677.11	20.03	677.10	20.03	677.16	20.03	677.21
	090BZ	5	24.64	676.76	24.64	676.80	24.64	676.80	24.64	676.76
	090BZ	6	25.93	675.29	26.24	675.30	26.24	675.02	26.24	674.85
	090BZ	7	29.98	674.44	28.67	674.80	28.67	674.51	28.67	674.40
	090BZ	8	34.93	673.90	32.53	674.40	32.53	674.29	32.53	674.18
	090BZ	9	39.99	673.52	36.53	673.90	36.53	673.83	36.53	673.86
	090BZ	10	44.94	672.81	40.58	673.70	40.58	673.54	40.58	673.49
	090BZ	11	49.91	672.74	44.49	673.50	44.49	673.15	44.49	673.08
	090BZ	12	54.86	672.48	48.48	673.40	48.48	673.02	48.48	672.70
	090BZ	13	59.79	672.47	53.60	673.10	53.60	672.83	53.60	672.62
	094AX	1	42.22	669.56	42.15	669.77	42.15	669.97	42.15	669.52
	094AX	2	36.56	669.84	37.19	669.66	37.19	670.00	37.19	669.65
	094AX	3	34.72	670.05	34.79	669.84	34.79	670.00	34.79	669.70
	094AX	4	32.88	671.41	32.82	671.32	32.82	671.15	32.82	670.81
	094AX	5	30.62	672.77	30.91	672.59	30.91	672.40	30.91	671.94
	094AX	6	28.64	673.78	28.99	673.98	28.99	673.30	28.99	673.60
	094AX	7	26.45	673.96	26.80	675.61	26.80	674.09	26.80	673.87
	094AX	8	24.89	675.85	24.89	675.50	24.89	675.82	24.89	675.77
	094AX	9	20.08	675.64	20.08	675.54	20.08	675.65	20.08	675.61
	094AX	10	15.07	675.63	15.07	675.80	15.07	675.64	15.07	675.60
	094AX	11	9.97	675.74	9.97	675.85	9.97	675.75	9.97	675.70
	094AX	12	0.00	675.99	0.00	676.10	0.00	676.00	0.00	675.94
	094AY	1	41.91	669.59	41.94	669.68	41.94	669.78	41.94	669.52
	094AY	2	37.00	669.65	37.08	669.61	37.08	669.85	37.08	669.57
	094AY	3	35.25	669.63	34.98	669.78	34.98	669.95	34.98	669.49
	094AY	4	32.87	670.13	33.06	669.73	33.06	669.49	33.06	669.54
	094AY	5	30.92	672.37	30.84	672.07	30.84	669.82	30.84	669.80
	094AY	6	29.98	672.82	29.11	673.97	29.11	674.67	29.11	674.53
	094AY	7	29.84	675.44	NA**	NA**	NA**	NA**	NA**	NA**
	094AY	8	29.18	675.54	28.09	674.61	28.09	675.25	28.09	674.69
	094AY	9	27.01	675.71	27.10	675.69	27.10	675.66	27.10	675.64

APPENDIX B

ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

EROSION PIN MONITORING DATA
FALL 2000-2002
SURVEY DATA

Impoundment*	Transect	Location Number	October 2000		March 2001 (2001A)		October 2001 (2001B)		November 2002	
			Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)	Distance (ft)	Elevation (ft)
	094AY	10	NA**	NA**	25.07	675.84	25.07	675.81	25.07	675.76
	094AY	11	20.22	675.82	20.22	675.88	20.22	675.84	20.22	675.78
	094AY	12	15.42	675.61	15.42	675.61	15.42	675.46	15.42	675.58
	094AY	13	9.93	675.48	9.93	675.53	9.93	675.50	9.93	675.46
	094AY	14	0.00	676.07	0.00	676.11	0.00	676.08	0.00	676.01
	094AZ	1	38.53	669.77	38.64	669.89	38.64	669.83	38.64	669.77
	094AZ	2	33.48	669.99	33.70	669.91	33.70	669.93	33.70	669.86
	094AZ	3	32.23	670.21	32.26	670.01	32.26	670.00	32.26	669.90
	094AZ	4	30.54	672.78	31.76	670.07	31.76	670.10	31.76	669.98
	094AZ	5	28.93	673.87	30.54	672.64	30.54	672.27	30.54	670.10
	094AZ	6	27.87	673.99	27.73	673.26	27.73	673.05	27.73	672.70
	094AZ	7	27.35	673.98	26.33	675.32	26.33	673.41	26.33	675.08
	094AZ	8	26.27	675.34	26.22	675.33	26.22	675.32	26.22	675.27
	094AZ	9	24.63	675.50	24.63	675.87	24.63	675.59	24.63	675.45
	094AZ	10	19.83	675.47	19.83	675.74	19.83	675.50	19.83	675.46
	094AZ	11	14.92	675.74	14.92	675.70	14.92	675.74	14.92	675.71
	094AZ	12	9.77	675.78	9.77	675.82	9.77	675.80	9.77	675.71
	094AZ	13	0.00	676.04	0.00	676.04	0.00	676.07	0.00	676.00
	094BX	1	0.00	682.81	0.00	682.83	0.00	682.83	0.00	682.73
	094BX	2	9.41	680.80	9.41	680.84	9.41	680.84	9.41	680.74
	094BX	3	13.37	679.56	13.37	679.61	13.37	679.61	13.37	679.59
	094BX	4	19.24	677.59	19.24	677.64	19.24	677.63	19.24	677.63
	094BX	5	24.48	676.65	24.48	676.73	24.48	676.74	24.48	676.71
	094BX	6	27.04	674.94	27.40	675.25	27.40	674.85	27.40	674.88
	094BX	7	34.56	673.84	28.74	674.70	28.74	674.76	28.74	674.70
	094BX	8	44.43	672.40	32.71	674.12	32.71	674.08	32.71	674.02
	094BX	9	54.65	672.44	36.96	673.62	36.96	673.59	36.96	673.56
	094BX	10	64.56	672.38	40.67	672.85	40.67	672.78	40.67	672.90
	094BX	11	74.65	672.27	44.84	672.58	44.84	672.45	44.84	672.60
	094BX	12	84.58	672.29	48.49	672.52	48.49	672.80	48.49	672.73
	094BX	13	89.56	672.33	53.72	672.78	53.72	672.82	53.72	672.60
	094BY	1	0.00	683.35	0.00	683.35	0.00	683.37	0.00	683.31
	094BY	2	9.77	681.06	9.77	681.10	9.77	681.09	9.77	681.08
	094BY	3	15.00	679.81	15.00	679.86	15.00	679.80	15.00	679.82
	094BY	4	19.96	678.16	19.96	678.23	19.96	678.23	19.96	678.20
	094BY	5	25.36	676.43	25.36	676.52	25.36	676.53	25.36	676.51
	094BY	6	27.14	674.81	27.49	674.69	27.49	675.20	27.49	675.03
	094BY	7	34.99	673.33	35.14	673.43	35.14	673.34	35.14	673.45
	094BY	8	44.68	672.48	44.55	672.67	44.55	672.85	44.55	672.70
	094BY	9	54.53	672.47	54.61	672.80	54.61	672.79	54.61	672.66
	094BY	10	64.75	672.33	64.95	671.19	64.95	672.24	64.95	672.03
	094BY	11	74.76	672.38	75.08	671.16	75.08	671.49	75.08	671.44
	094BY	12	84.91	672.52	85.14	671.17	85.14	671.34	85.14	671.71
	094BY	13	89.70	672.44	90.10	671.24	90.10	671.77	90.10	671.76
	094BZ	1	0.00	686.40	0.00	686.39	0.00	686.38	0.00	686.36
	094BZ	2	9.44	681.68	9.44	681.72	9.44	681.69	9.44	681.69
	094BZ	3	13.66	680.26	13.66	680.29	13.66	680.27	13.66	680.27
	094BZ	4	18.97	678.05	18.97	678.08	18.97	678.08	18.97	678.06
	094BZ	5	24.06	676.13	24.06	676.16	24.06	676.16	24.06	676.12
	094BZ	6	26.24	674.81	29.46	674.01	29.46	673.95	29.46	673.95
	094BZ	7	28.16	674.27	33.47	673.38	33.47	673.44	33.47	673.33
	094BZ	8	32.58	673.64	42.89	671.47	42.89	671.96	42.89	672.02
	094BZ	9	35.93	672.87	53.27	673.02	53.27	672.99	53.27	672.82
	094BZ	10	39.60	672.11	63.64	671.66	63.64	670.55	63.64	670.96
	094BZ	11	43.38	671.89	73.32	671.44	73.32	671.69	73.32	671.92
	094BZ	12	47.61	672.27	83.65	671.92	83.65	672.25	83.65	672.08
	094BZ	13	52.72	672.59	88.52	671.83	88.52	672.19	88.52	672.06
FTI	099AX	1	90.02	656.67	90.61	656.65	90.61	656.63	90.61	656.78
	099AX	2	84.80	656.83	85.19	656.74	85.19	656.82	85.19	656.83
	099AX	3	75.23	657.27	75.72	657.23	75.72	657.26	75.72	657.32
	099AX	4	65.05	657.62	65.56	657.67	65.56	657.64	65.56	657.82
	099AX	5	55.07	659.18	55.44	659.36	55.44	659.35	55.44	659.30
	099AX	6	45.01	660.30	45.30	660.36	45.30	660.39	45.30	660.43

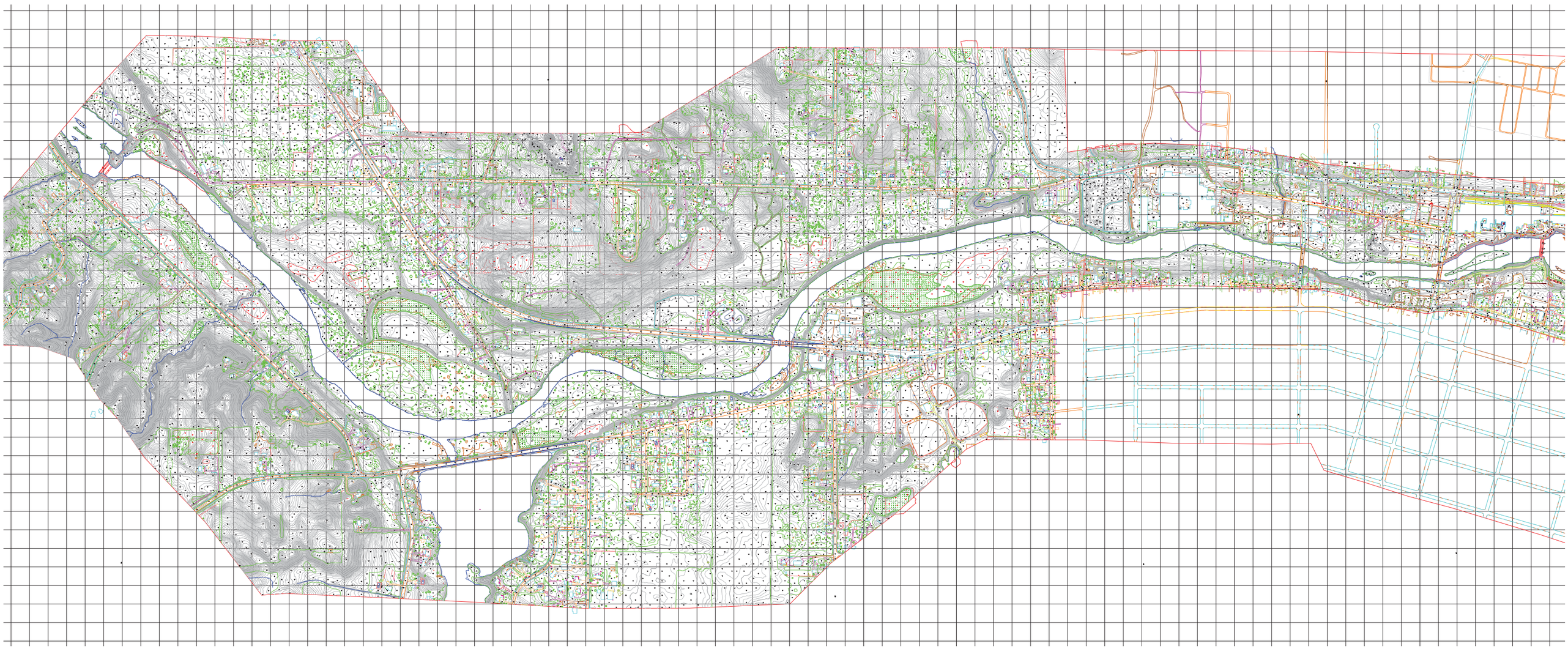
ARCADIS

Appendix E

Axis Geospatial Survey Maps and DVD with Data

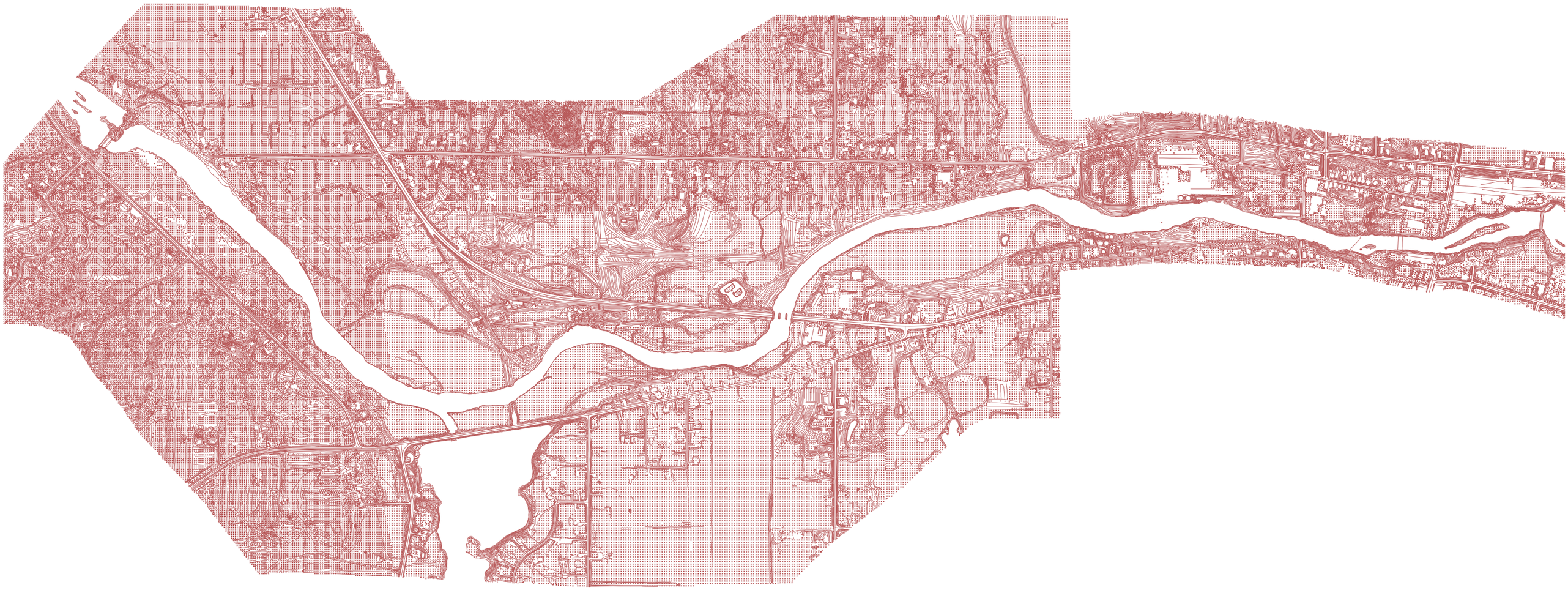
AERIAL PHOTOGRAPH DERIVED FROM
ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC.
OTSEGO AREA FLOWN APRIL 2010

G:\COMMON\64524\10 Final Reports and Presentations\2012 Area 3 SRIFS WP\Appendices\Appendix E - Axis Geospatial Data



MAPPING DERIVED FROM ORTHOGRAPHIC
DATA BY AXIS GEOSPATIAL, LLC.
OTSEGO AREA FLOWN APRIL 2010

G:\COMMON\64524\10 Final Reports and Presentations\2012 Area 3 SRIFS WP\Appendices\Appendix E - Axis Geospatial Data



DIGITAL TERRAIN MODEL DERIVED FROM
ORTHOGRAPHIC DATA BY AXIS GEOSPATIAL, LLC.
OTSEGO AREA FLOWN APRIL 2010

G:\COMMON\64524\10 Final Reports and Presentations\2012 Area 3 SRIFS WP\Appendices\Appendix E - Axis Geospatial Data

ARCADIS

Summary of metadata provided by Axis Geospatial

Project was flown in COLOR on 03-31-2010 at a flight height of 1800' above the mean terrain height (AMT) which creates a negative scale of 1"=300'. There were 3 flight lines and 90 exposures captured.

High resolution scanning of the aerial film was done at a resolution of 15 microns or 1693 DPI

Aero-Triangulation was performed to geo-reference the imagery and resulting adjustments were analyzed to meet accuracy requirements for mapping scale

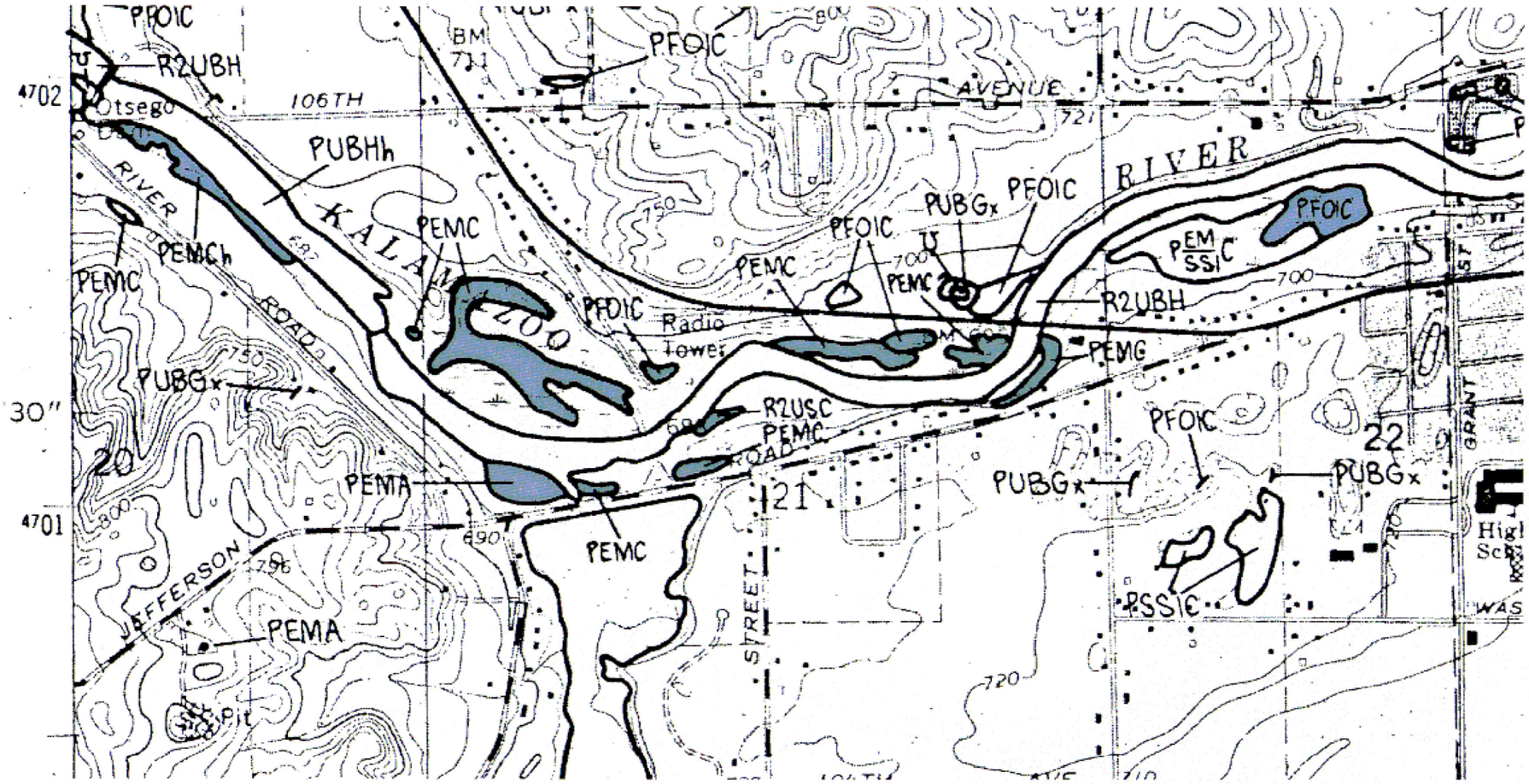
All data was stereo captured in 3D providing and X, Y, and Z data coordinate value for each point digitized.

Accuracy of data meets or exceeds the National Map Accuracy Standards for 1"=40' w/ 1' contour intervals which for this data is +/- 1' horizontal accuracy and .5' vertical accuracy for contour lines and .33' vertical accuracy for spot elevation.

Horizontal Datum: Michigan State Plane, NAD 83 (International feet)
Vertical Datum: NGVD29 (US feet)

Appendix F

Area 3 Wetland Map by National Wetland Inventory



NOTE:

BASE MAPPING TAKEN FROM NATIONAL WETLAND INVENTORY MAP FOR OTSEGO, MICHIGAN, PREPARED BY THE UNITED STATES DEPARTMENT OF THE INTERIOR, FROM AERIAL PHOTOGRAPHY DATED 5/81.

LEGEND:

NWI WETLANDS OF THE FORMER OTSEGO IMPOUNDMENT

0 1000' 2000'

GRAPHIC SCALE

DRAFT

FOR STATE AND FEDERAL REVIEW

KALAMAZOO RIVER STUDY GROUP
ALLIED PAPER, INC./PORTAGE CREEK/KALAMAZOO RIVER SUPERFUND SITE

REMEDIAL INVESTIGATION REPORT

NWI WETLANDS OF THE FORMER OTSEGO IMPOUNDMENT

BBL BLASLAND, BOUCK & LEE, INC. *engineers & scientists*

FIGURE 5

X: 64524X02.TIF, 64524X00.DWG
L: ON=*;OFF=REF*
P: STD/BL.PCP
10/26/00 SYR-54-NES KMD
64524300/APPEND/64524C005.DWG